FIG. 1

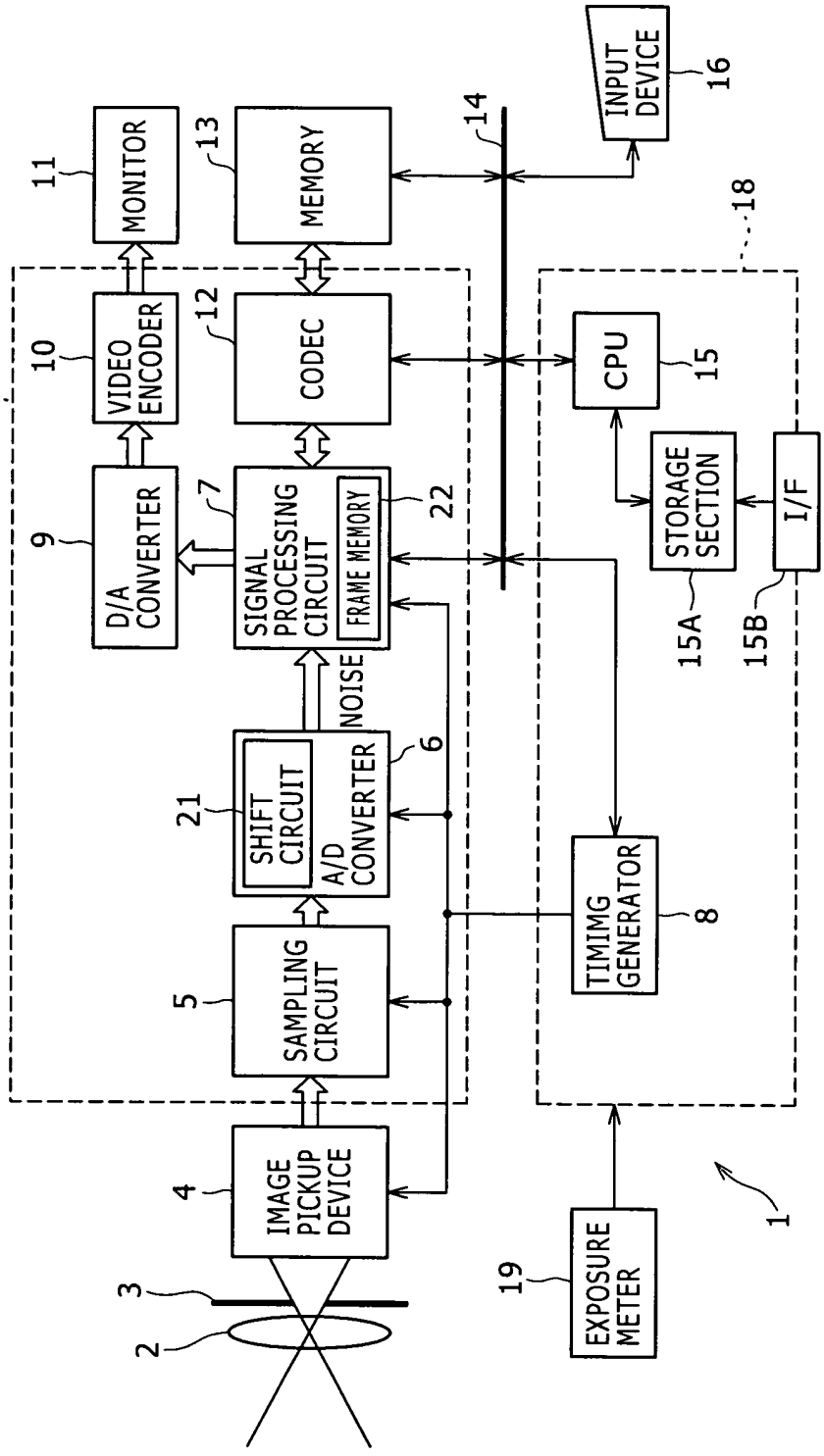

INPUT DEVICE
16
MONITOR
11
MEMORY
13
14
18
17
VIDEO ENCODER
10
CODEC
12
CPU
15
D/A CONVERTER
9
SIGNAL PROCESSING CIRCUIT
7
FRAME MEMORY
22
STORAGE SECTION
I/F
15A
15B
NOISE
SHIFT CIRCUIT
21
A/D CONVERTER
6
SAMPLING CIRCUIT
5
TIMIMG GENERATOR
8
IMAGE PICKUP DEVICE
4
3
2
EXPOSURE METER
19
1

FIG. 2

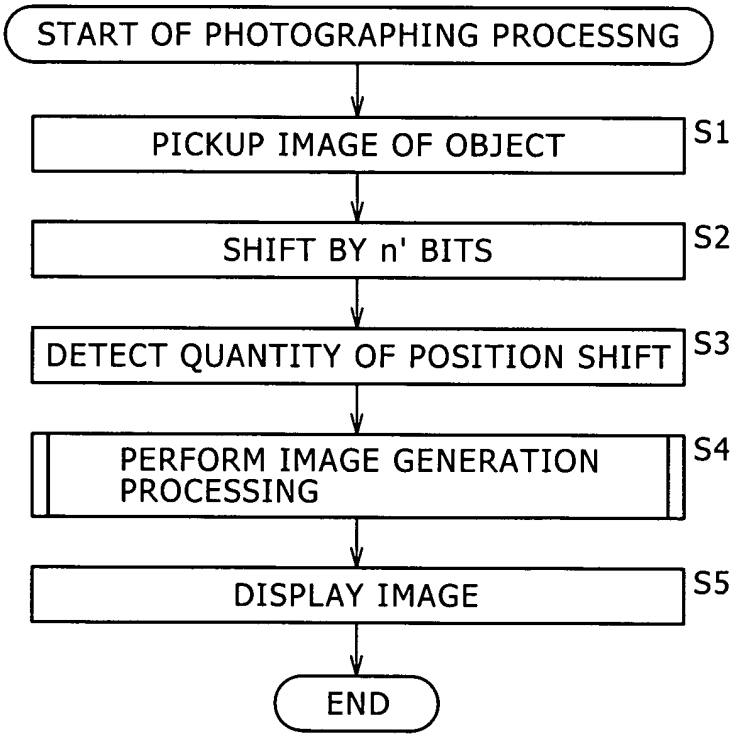

START OF PHOTOGRAPHING PROCESSNG
PICKUP IMAGE OF OBJECT
S1
SHIFT BY n' BITS
S2
DETECT QUANTITY OF POSITION SHIFT
S3
PERFORM IMAGE GENERATION PROCESSING
S4
DISPLAY IMAGE
S5
END

FIG. 3

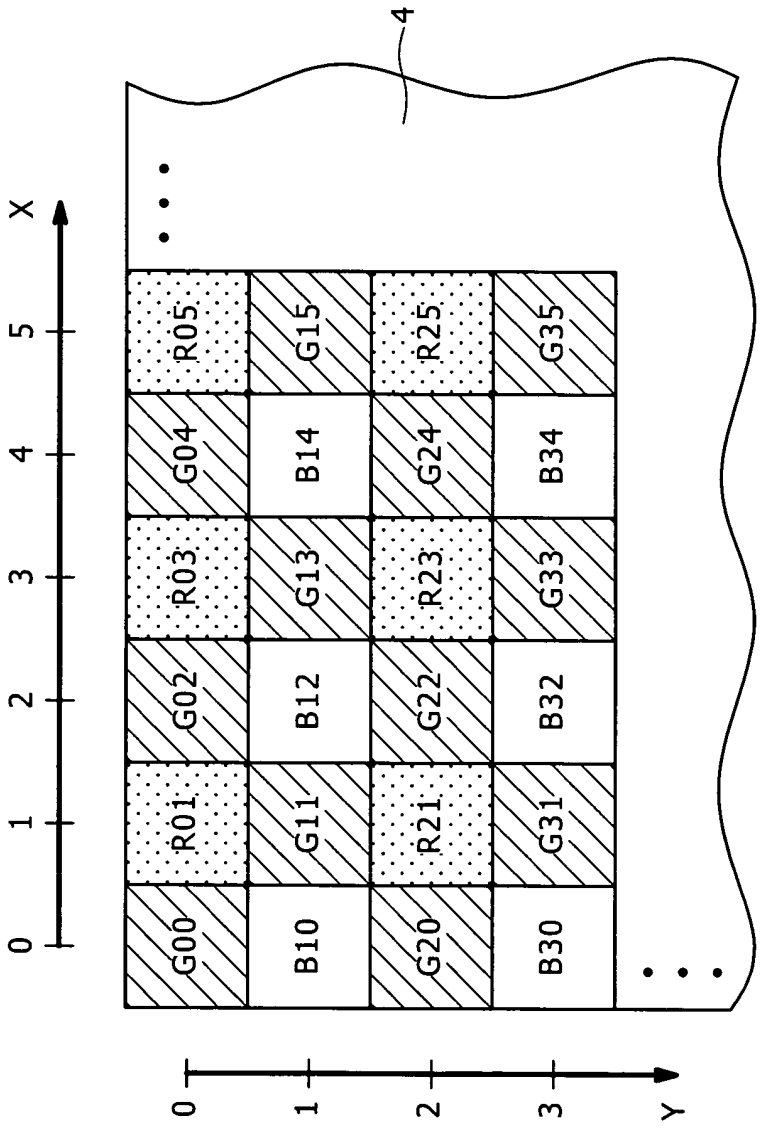

4
X
0
1
2
3
4
5
Y
0
1
2
3
R05
G15
R25
G35
G04
B14
G24
B34
R03
G13
R23
G33
G02
B12
G22
B32
R01
G11
R21
G31
G00
B10
G20
B30

FIG. 4

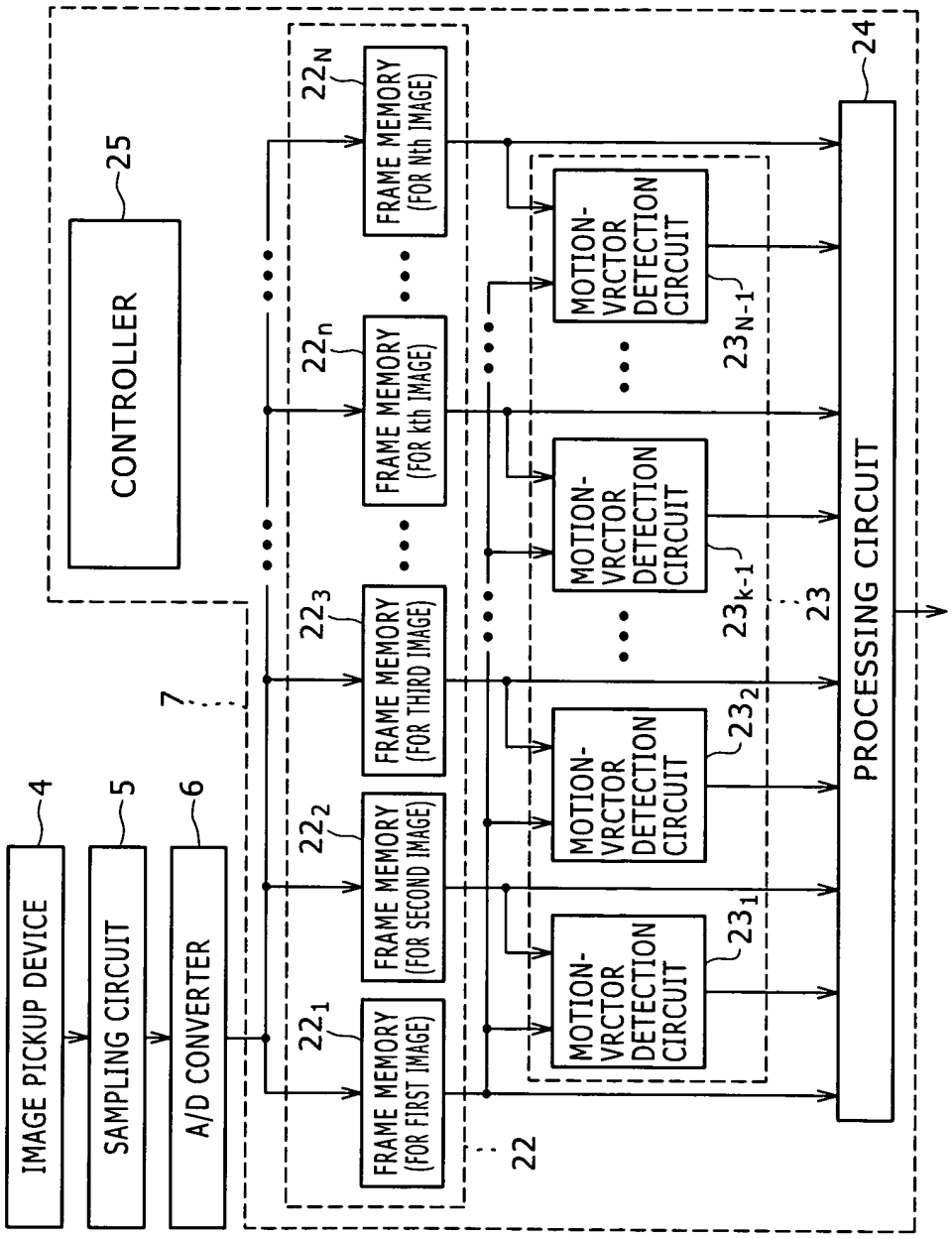


IMAGE PICKUP DEVICE
4
SAMPLING CIRCUIT
5
A/D CONVERTER
6
7
CONTROLLER
25
22
FRAME MEMORY (FOR FIRST IMAGE)
22_1
FRAME MEMORY (FOR SECOND IMAGE)
22_2
FRAME MEMORY (FOR THIRD IMAGE)
22_3
FRAME MEMORY (FOR kth IMAGE)
22_n
FRAME MEMORY (FOR Nth IMAGE)
22_N
MOTION-VRCTOR DETECTION CIRCUIT
23_1
MOTION-VRCTOR DETECTION CIRCUIT
23_2
MOTION-VRCTOR DETECTION CIRCUIT
23_{k-1}
MOTION-VRCTOR DETECTION CIRCUIT
23_{N-1}
23
PROCESSING CIRCUIT
24

FIG. 5

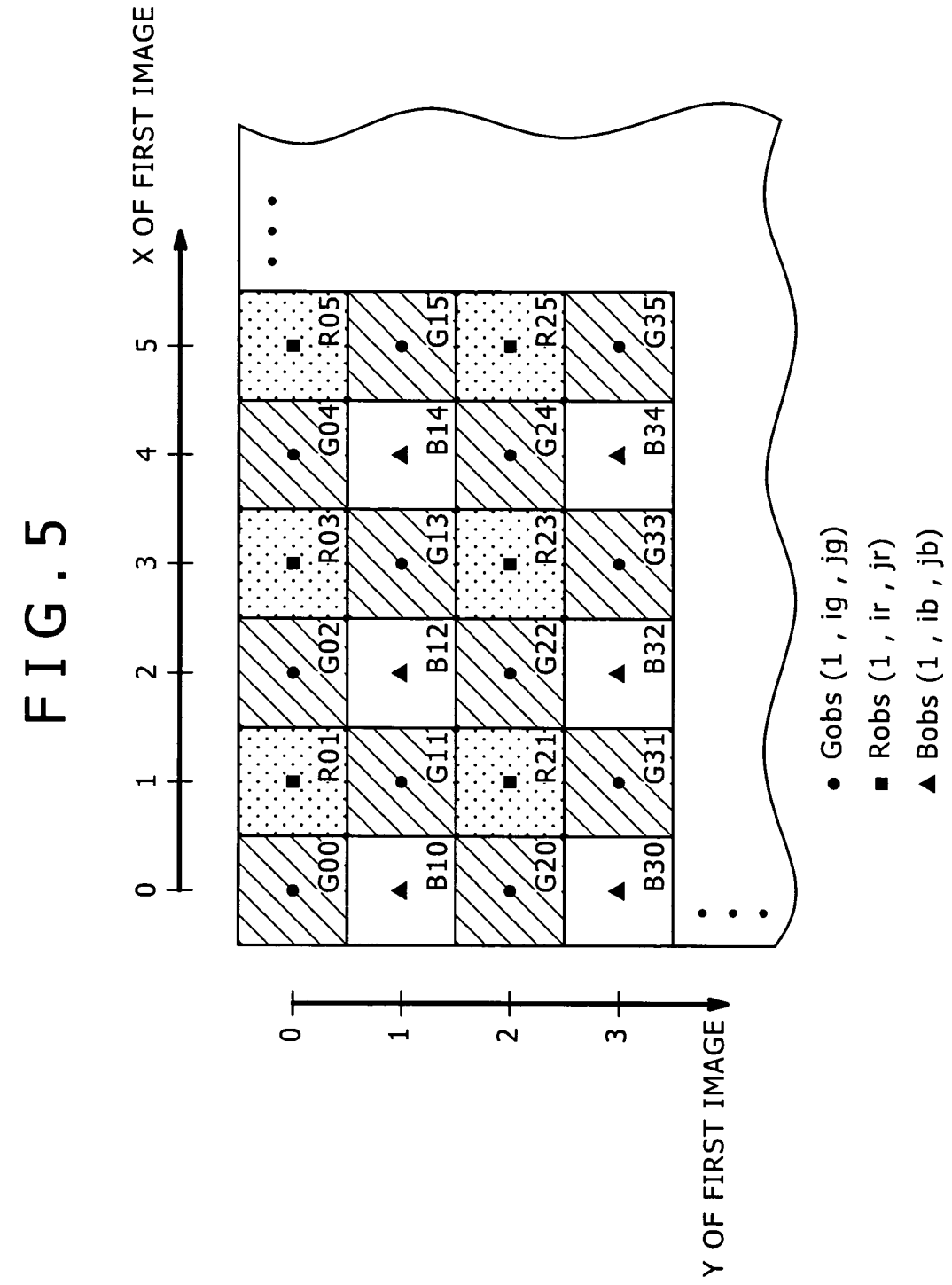

X OF FIRST IMAGE
0
1
2
3
4
5
Y OF FIRST IMAGE
0
1
2
3
G00
R01
G02
R03
G04
R05
B10
G11
B12
G13
B14
G15
G20
R21
G22
R23
G24
R25
B30
G31
B32
G33
B34
G35
● Gobs (1 , ig , jg)
■ Robs (1 , ir , jr)
▲ Bobs (1 , ib , jb)

FIG. 6

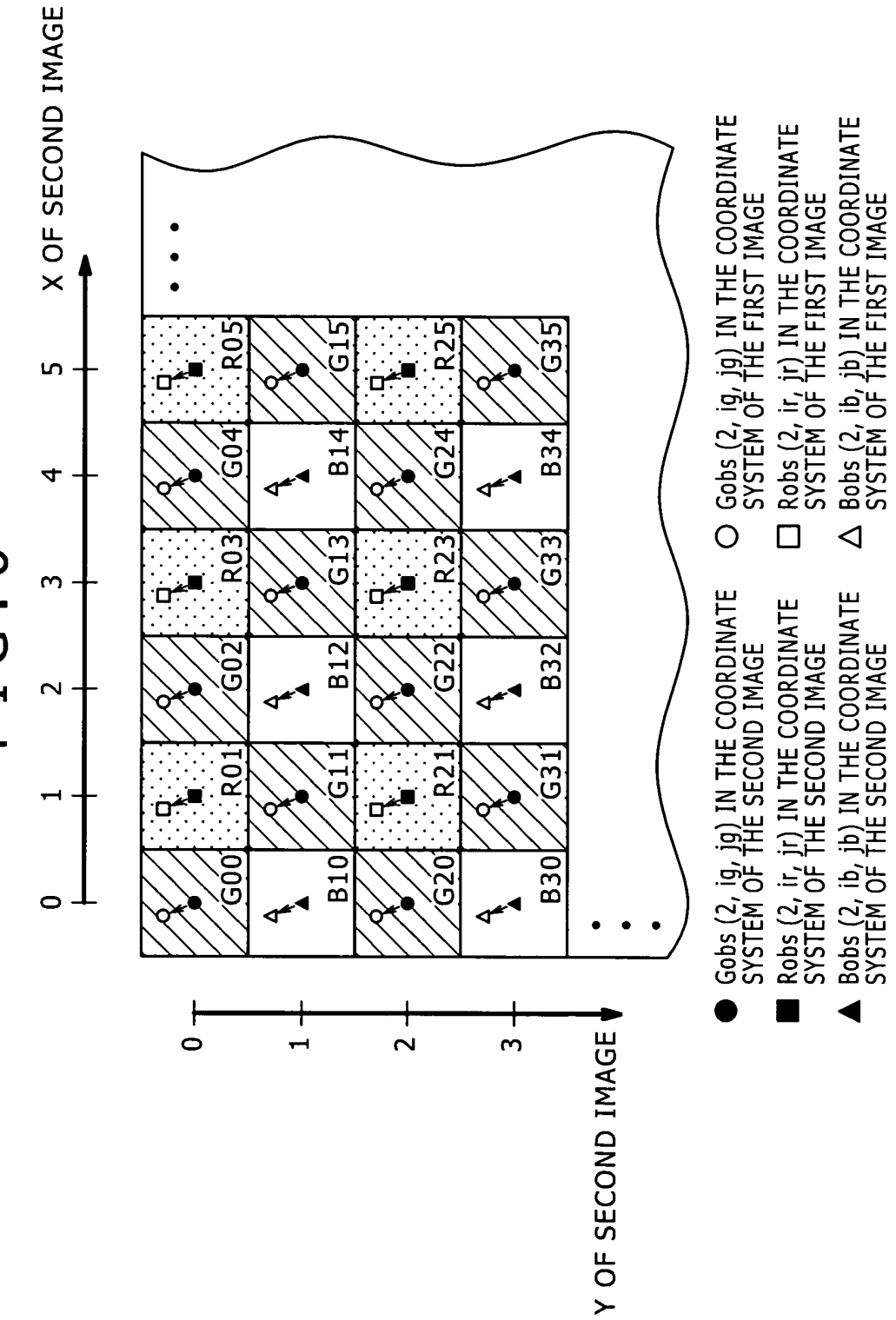

X OF SECOND IMAGE
0
1
2
3
4
5
Y OF SECOND IMAGE
0
1
2
3
G00
R01
G02
R03
G04
R05
B10
G11
B12
G13
B14
G15
G20
R21
G22
R23
G24
R25
B30
G31
B32
G33
B34
G35
Gobs (2, ig, jg) IN THE COORDINATE SYSTEM OF THE SECOND IMAGE
Robs (2, ir, jr) IN THE COORDINATE SYSTEM OF THE SECOND IMAGE
Bobs (2, ib, jb) IN THE COORDINATE SYSTEM OF THE SECOND IMAGE
Gobs (2, ig, jg) IN THE COORDINATE SYSTEM OF THE FIRST IMAGE
Robs (2, ir, jr) IN THE COORDINATE SYSTEM OF THE FIRST IMAGE
Bobs (2, ib, jb) IN THE COORDINATE SYSTEM OF THE FIRST IMAGE

FIG. 7

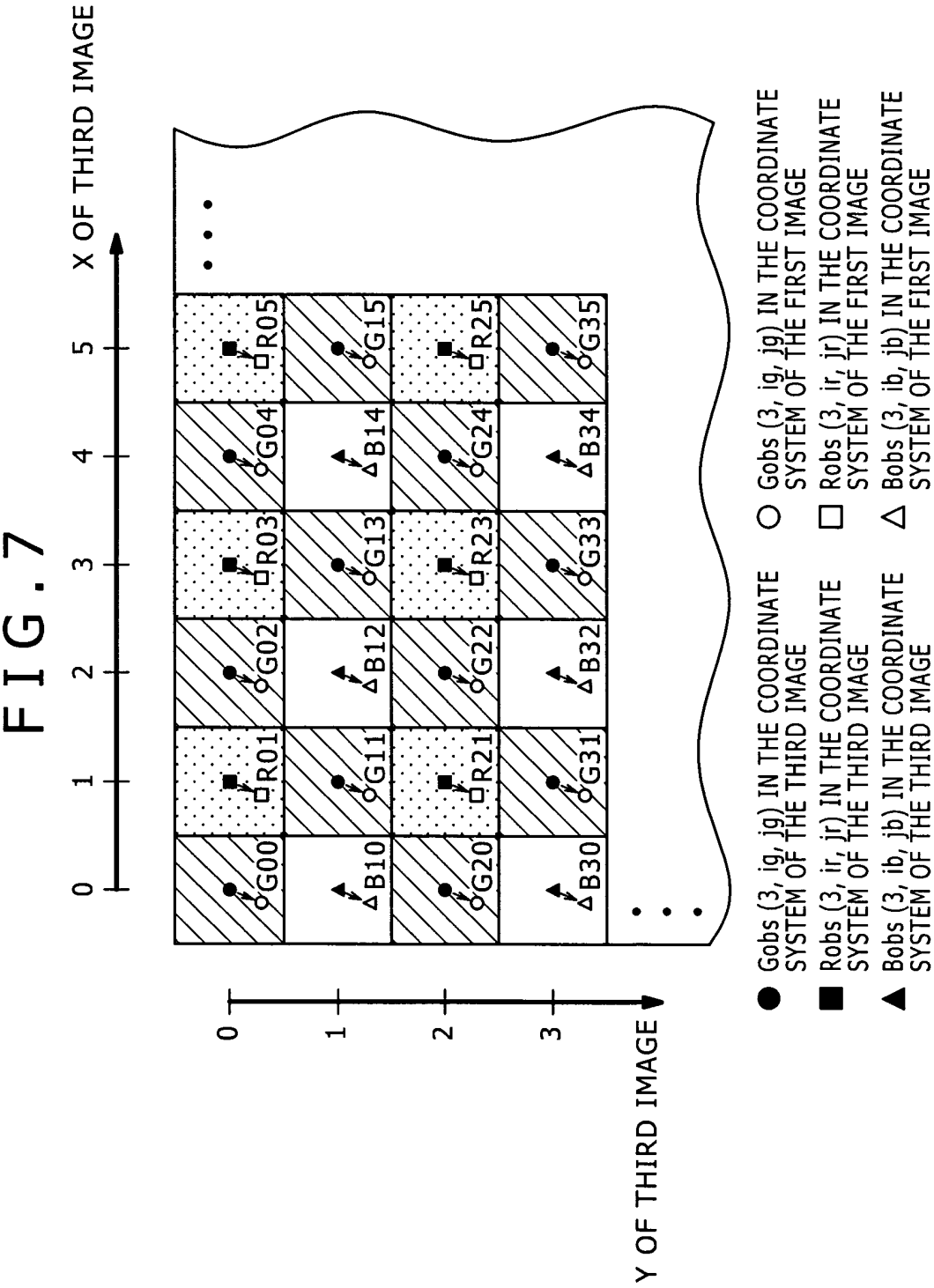

X OF THIRD IMAGE
Y OF THIRD IMAGE
0
1
2
3
4
5
G00
R01
G02
R03
G04
R05
B10
G11
B12
G13
B14
G15
G20
R21
G22
R23
G24
R25
B30
G31
B32
G33
B34
G35
Gobs (3, ig, jg) IN THE COORDINATE SYSTEM OF THE THIRD IMAGE
Robs (3, ir, jr) IN THE COORDINATE SYSTEM OF THE THIRD IMAGE
Bobs (3, ib, jb) IN THE COORDINATE SYSTEM OF THE THIRD IMAGE
Gobs (3, ig, jg) IN THE COORDINATE SYSTEM OF THE FIRST IMAGE
Robs (3, ir, jr) IN THE COORDINATE SYSTEM OF THE FIRST IMAGE
Bobs (3, ib, jb) IN THE COORDINATE SYSTEM OF THE FIRST IMAGE

FIG. 8

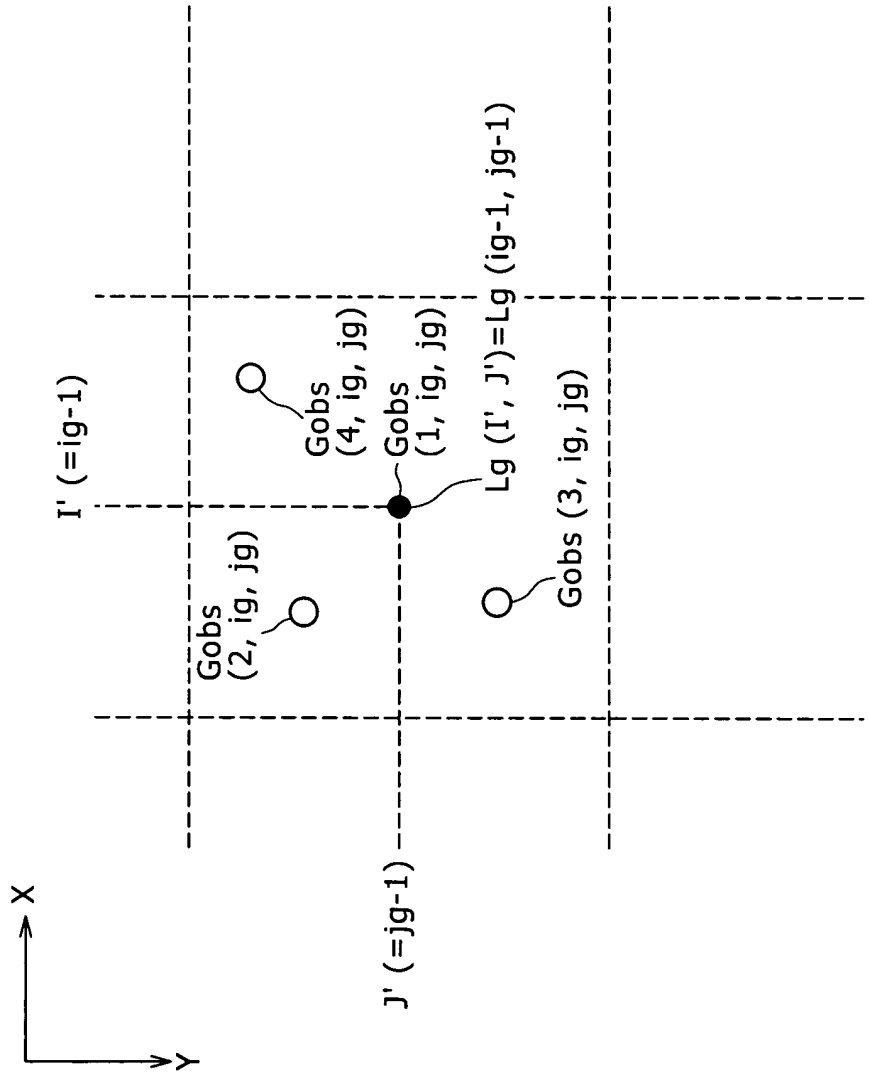

I' (=ig-1)
J' (=jg-1)
Gobs (4, ig, jg)
Gobs (1, ig, jg)
Lg (I', J')=Lg (ig-1, jg-1)
Gobs (2, ig, jg)
Gobs (3, ig, jg)
X
Y

FIG. 9

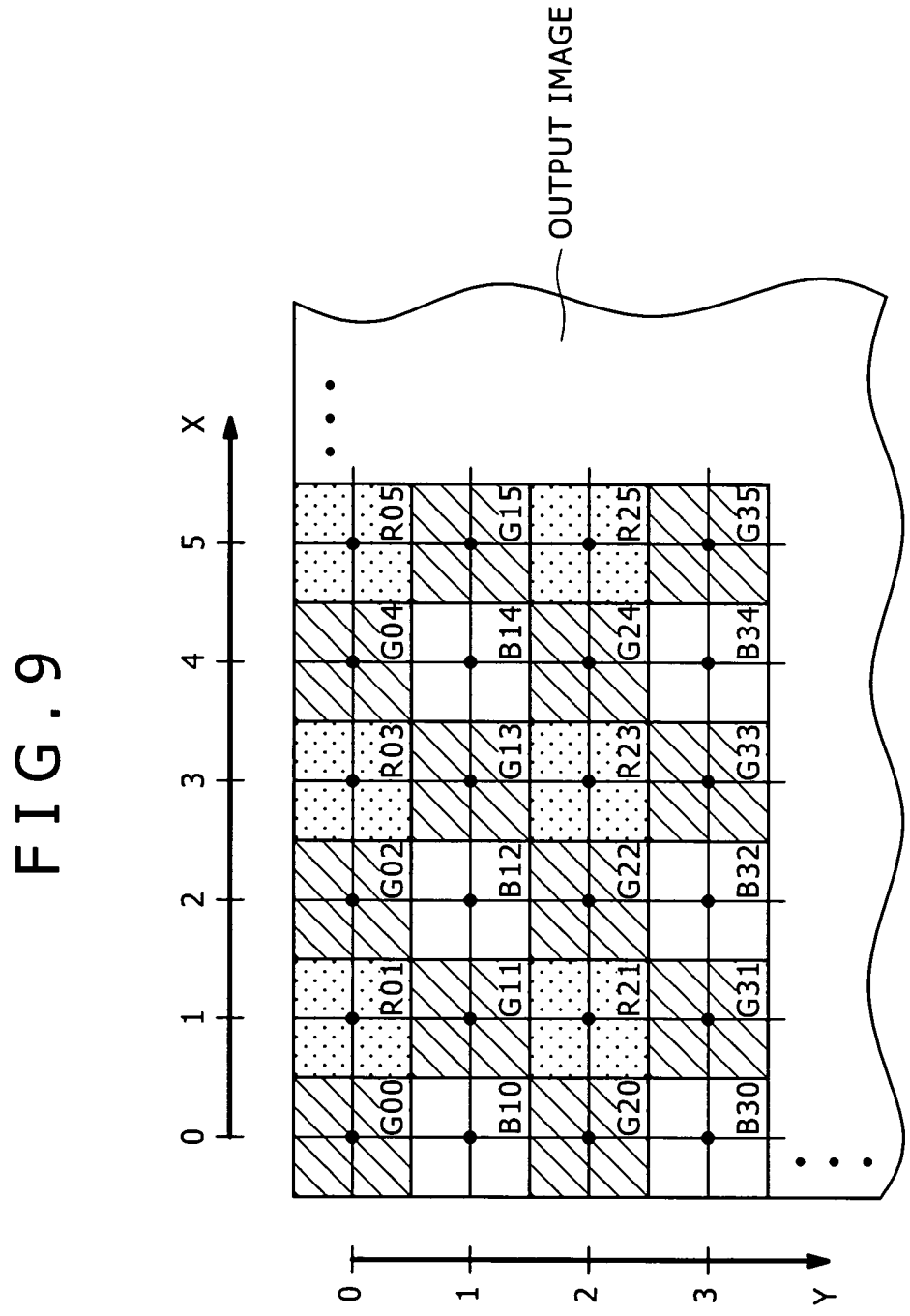

OUTPUT IMAGE
X
0
1
2
3
4
5
Y
0
1
2
3
G00
R01
G02
R03
G04
R05
B10
G11
B12
G13
B14
G15
G20
R21
G22
R23
G24
R25
B30
G31
B32
G33
B34
G35

FIG.10

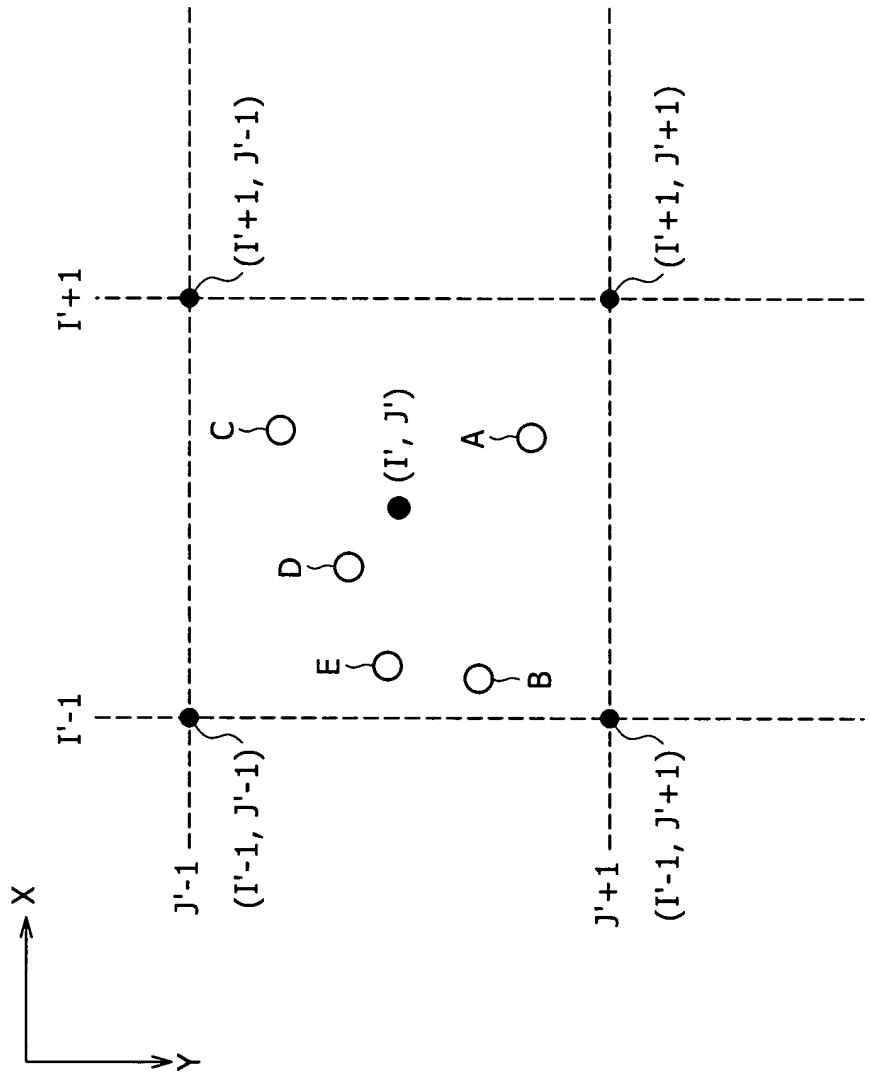


FIG. 11

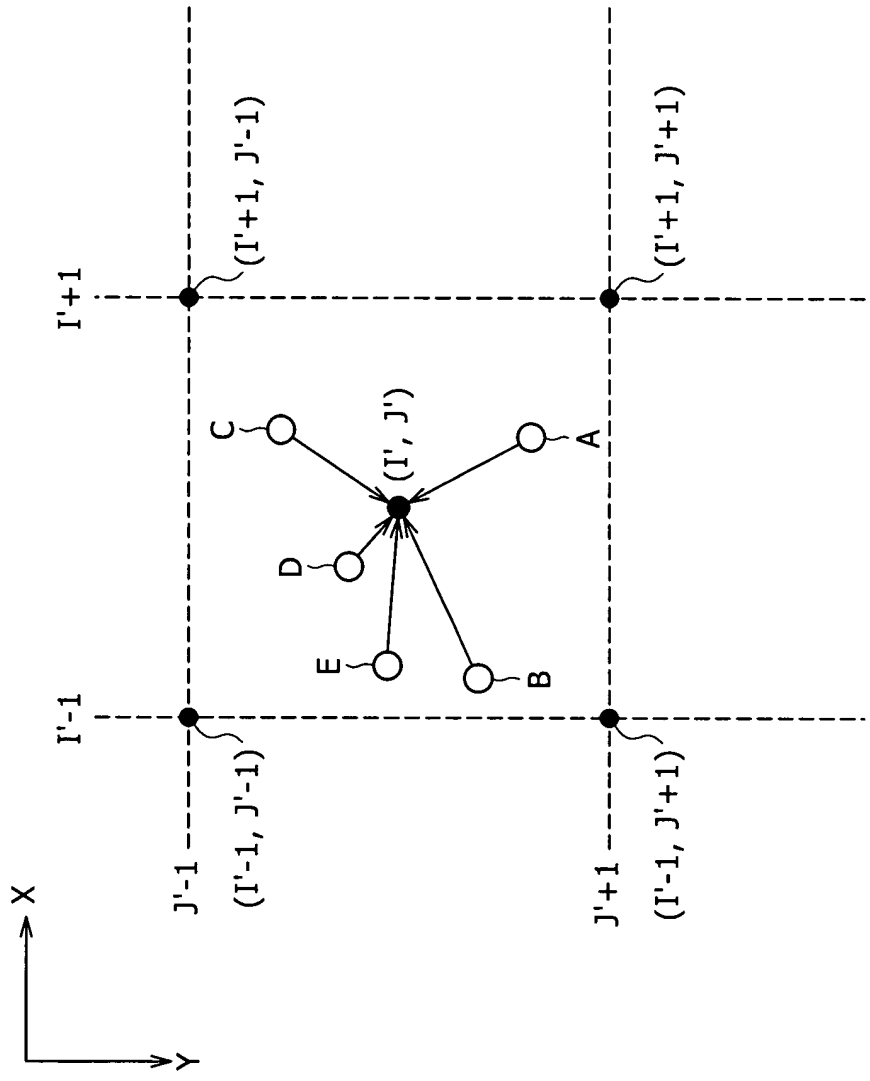


FIG. 12

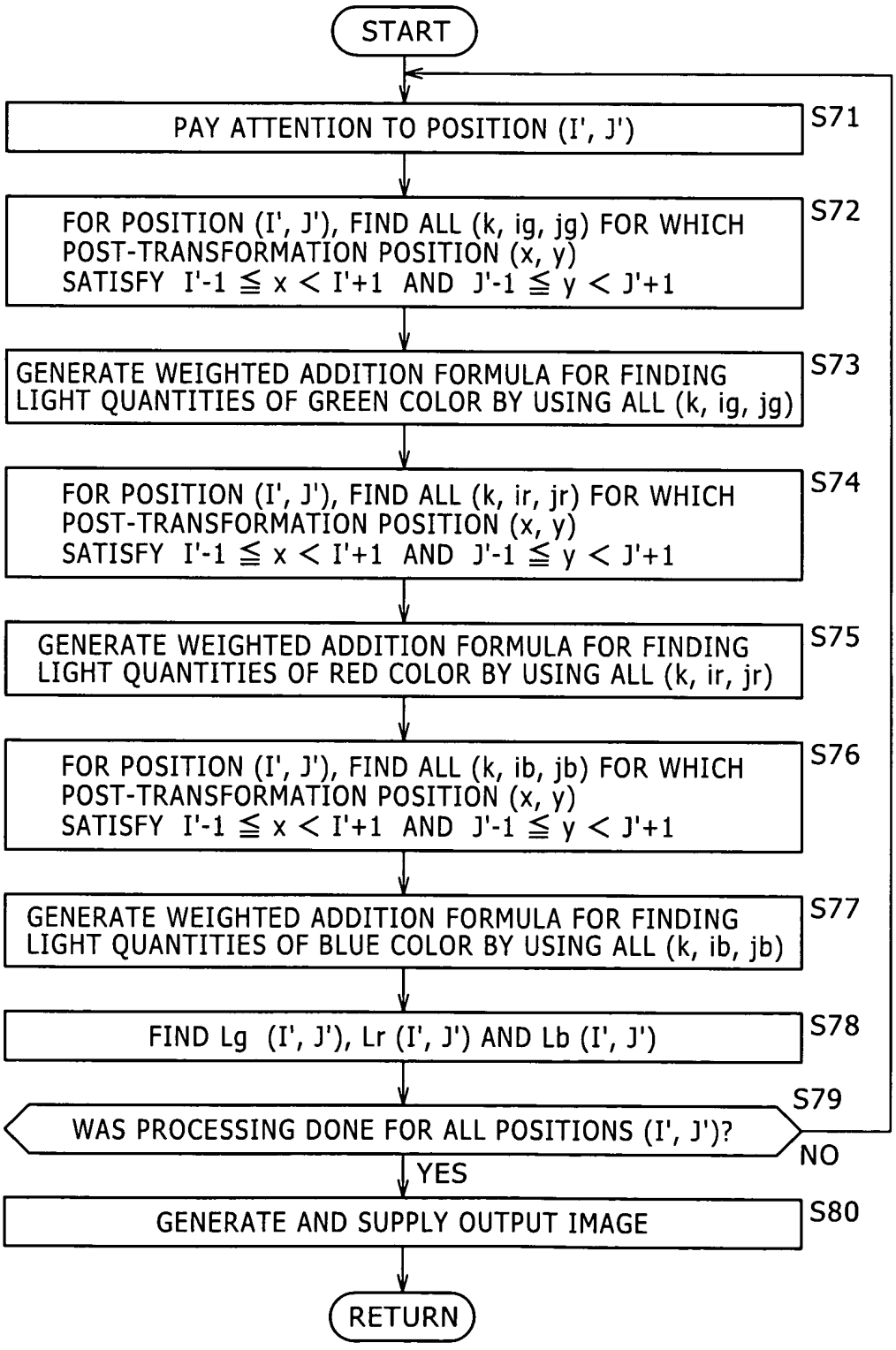

START
PAY ATTENTION TO POSITION (I', J')
S71
FOR POSITION (I', J'), FIND ALL (k, ig, jg) FOR WHICH POST-TRANSFORMATION POSITION (x, y) SATISFY I'-1 ≦ x < I'+1 AND J'-1 ≦ y < J'+1
S72
GENERATE WEIGHTED ADDITION FORMULA FOR FINDING LIGHT QUANTITIES OF GREEN COLOR BY USING ALL (k, ig, jg)
S73
FOR POSITION (I', J'), FIND ALL (k, ir, jr) FOR WHICH POST-TRANSFORMATION POSITION (x, y) SATISFY I'-1 ≦ x < I'+1 AND J'-1 ≦ y < J'+1
S74
GENERATE WEIGHTED ADDITION FORMULA FOR FINDING LIGHT QUANTITIES OF RED COLOR BY USING ALL (k, ir, jr)
S75
FOR POSITION (I', J'), FIND ALL (k, ib, jb) FOR WHICH POST-TRANSFORMATION POSITION (x, y) SATISFY I'-1 ≦ x < I'+1 AND J'-1 ≦ y < J'+1
S76
GENERATE WEIGHTED ADDITION FORMULA FOR FINDING LIGHT QUANTITIES OF BLUE COLOR BY USING ALL (k, ib, jb)
S77
FIND Lg (I', J'), Lr (I', J') AND Lb (I', J')
S78
WAS PROCESSING DONE FOR ALL POSITIONS (I', J')?
S79
NO
YES
GENERATE AND SUPPLY OUTPUT IMAGE
S80
RETURN

FIG.13

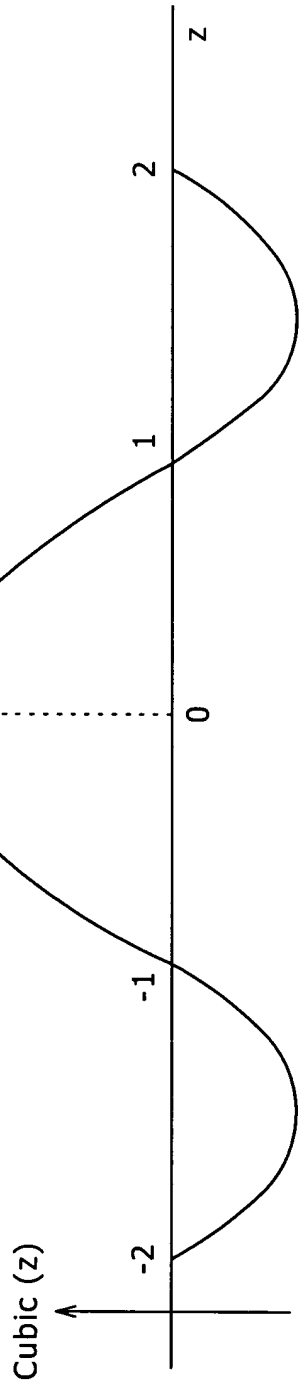


FIG.14

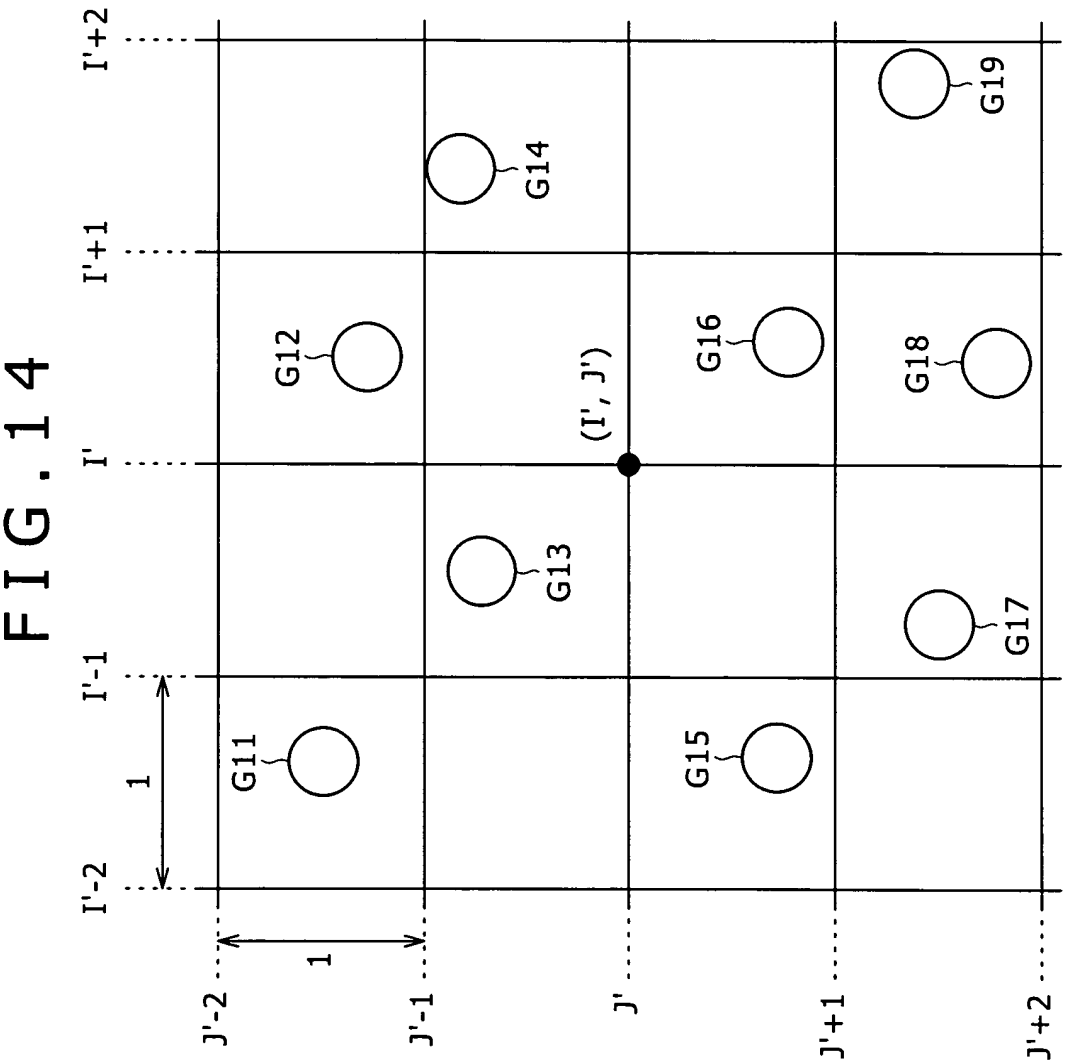


FIG. 15

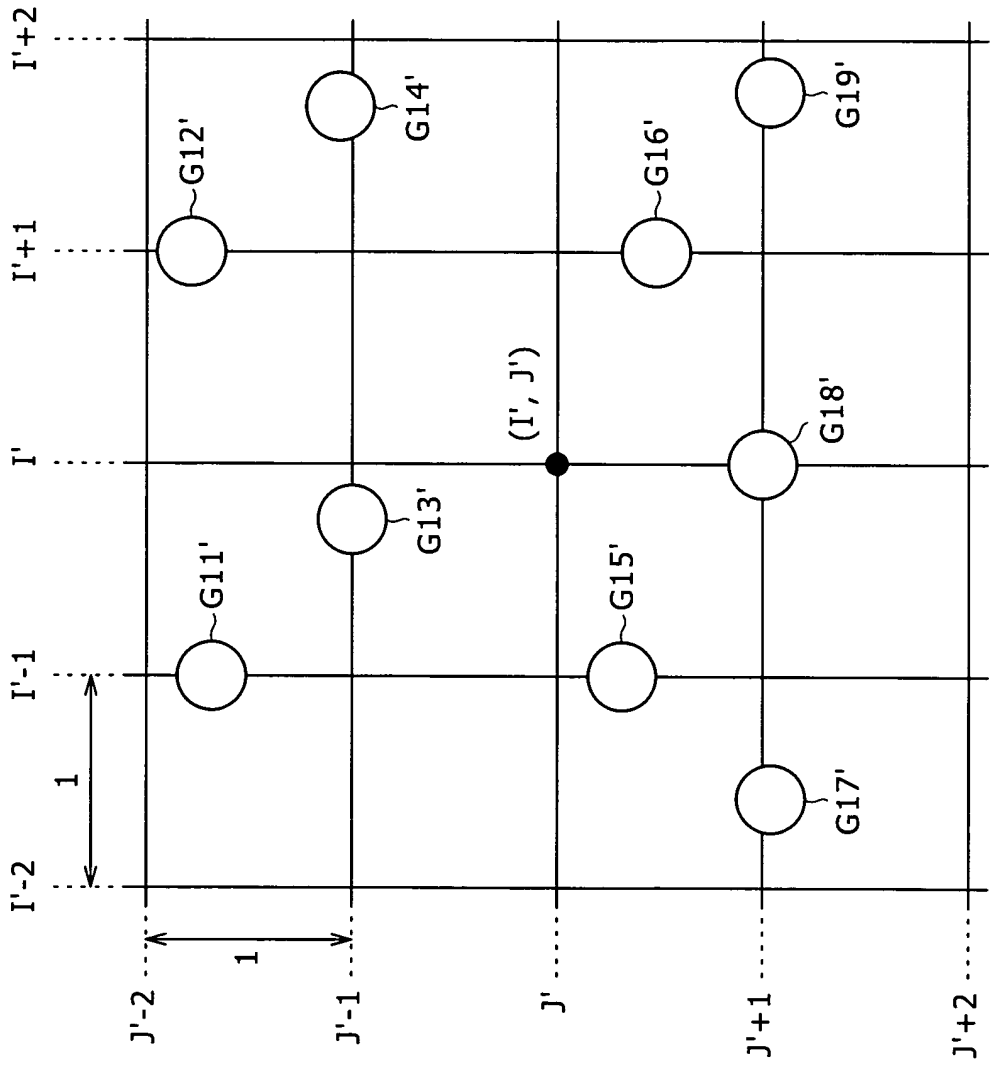


FIG. 16

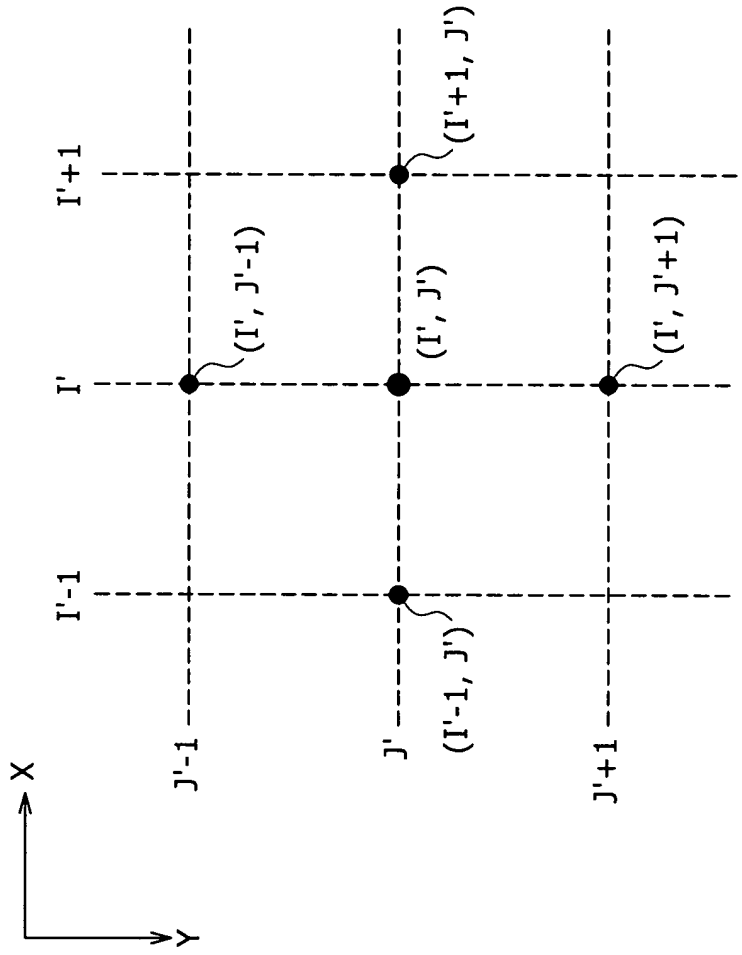


FIG.17

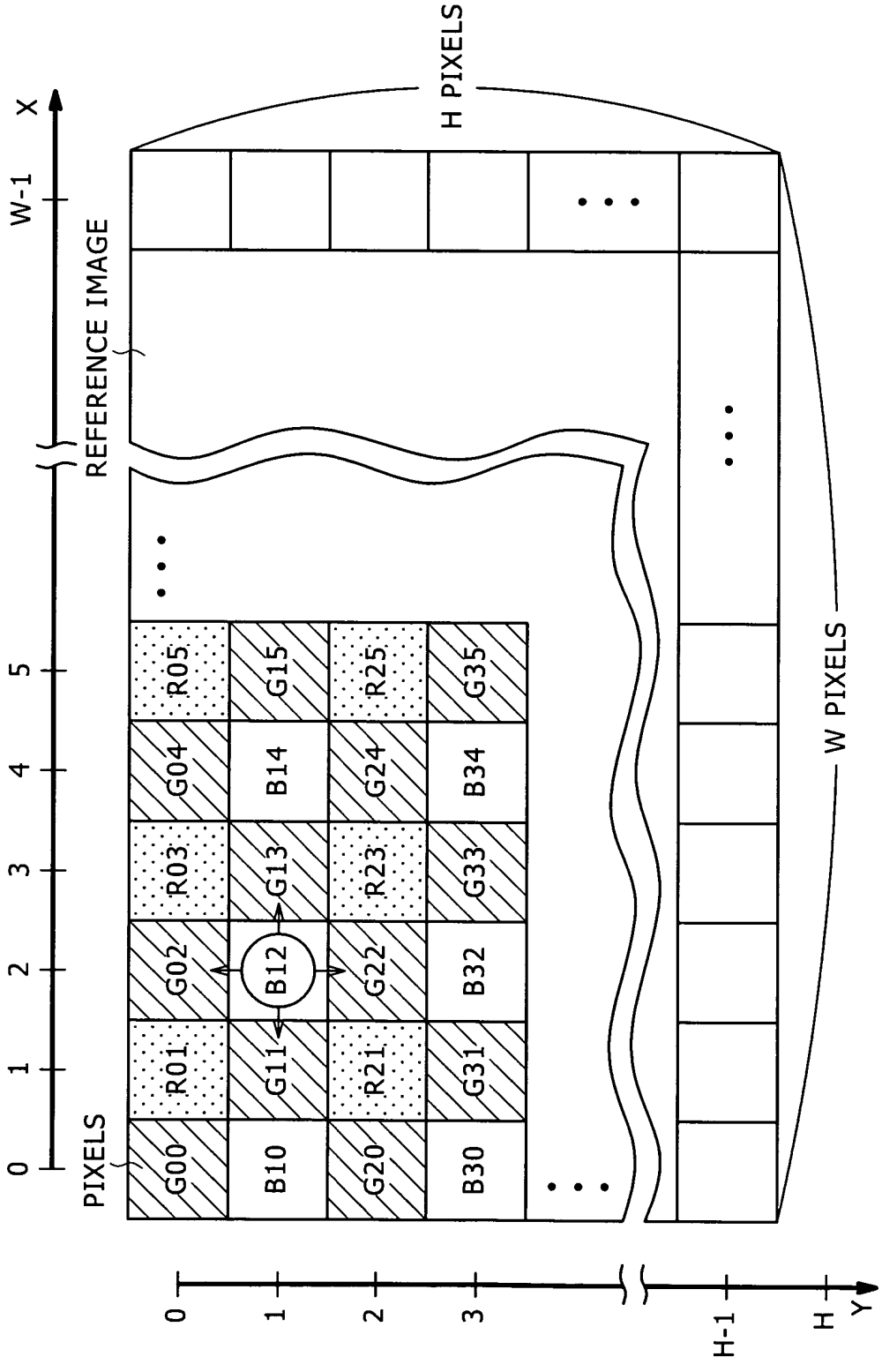

H PIXELS
W PIXELS
REFERENCE IMAGE
PIXELS
X
Y
W-1
H-1
H
0
1
2
3
4
5
G00
B10
G20
B30
R01
G11
R21
G31
G02
B12
G22
B32
R03
G13
R23
G33
G04
B14
G24
B34
R05
G15
R25
G35

FIG. 18

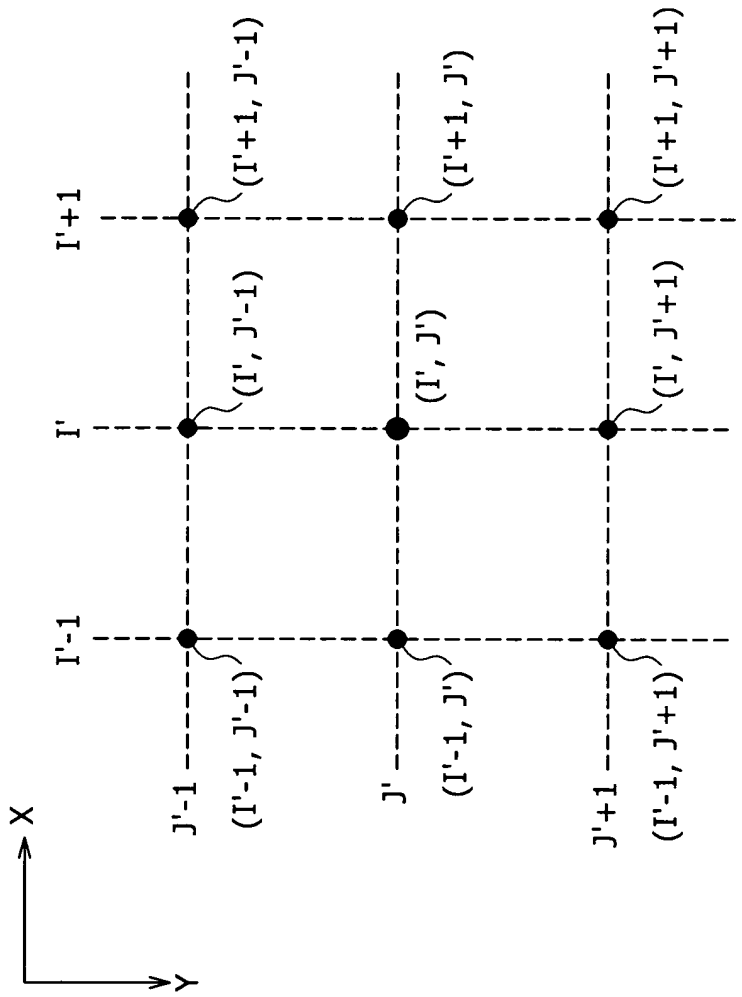


FIG.19

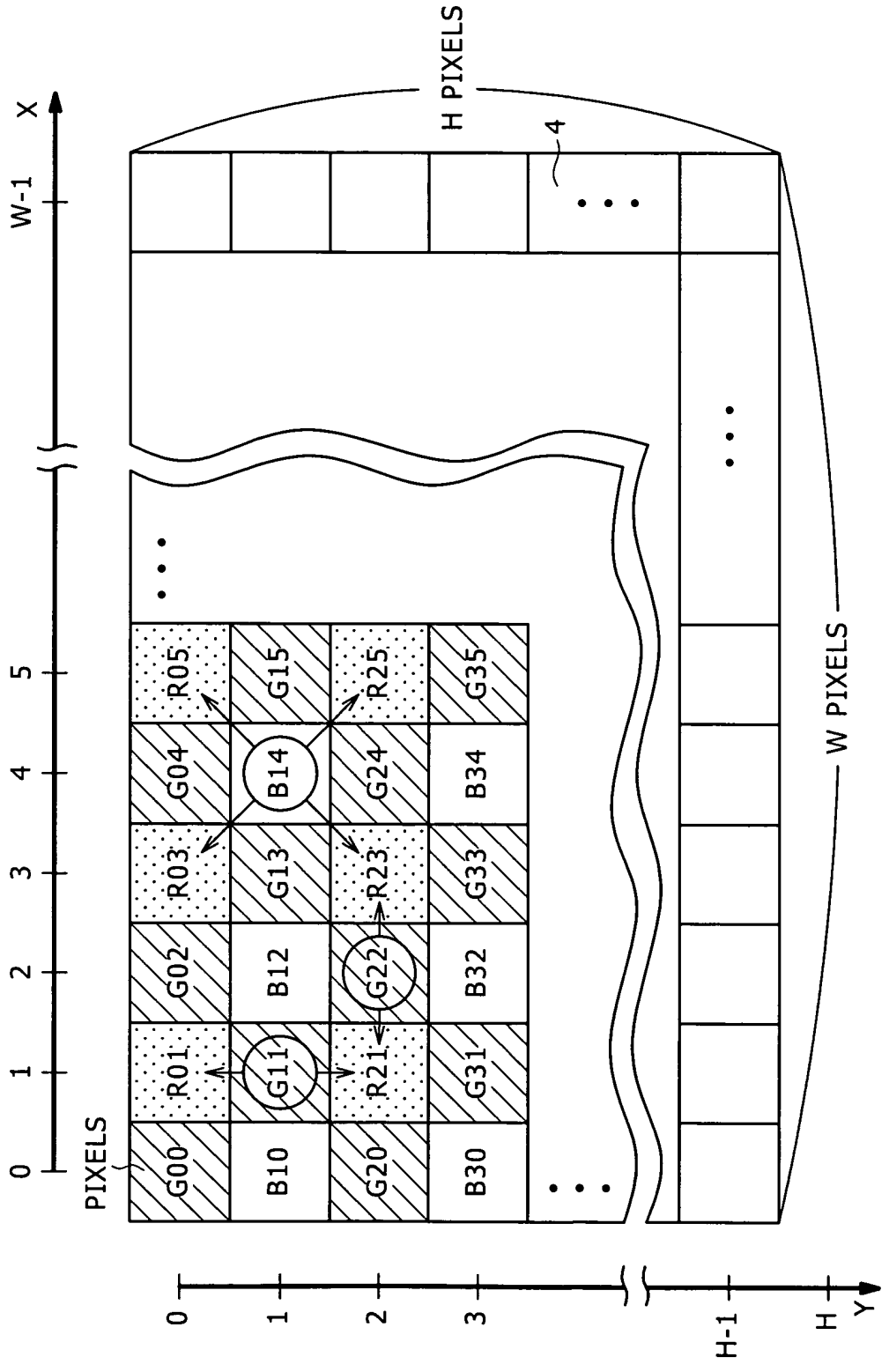

H PIXELS
W PIXELS
PIXELS
X
Y
W-1
H-1
0
1
2
3
4
5
H
G00
B10
G20
B30
R01
G11
R21
G31
G02
B12
G22
B32
R03
G13
R23
G33
G04
B14
G24
B34
R05
G15
R25
G35

FIG. 20

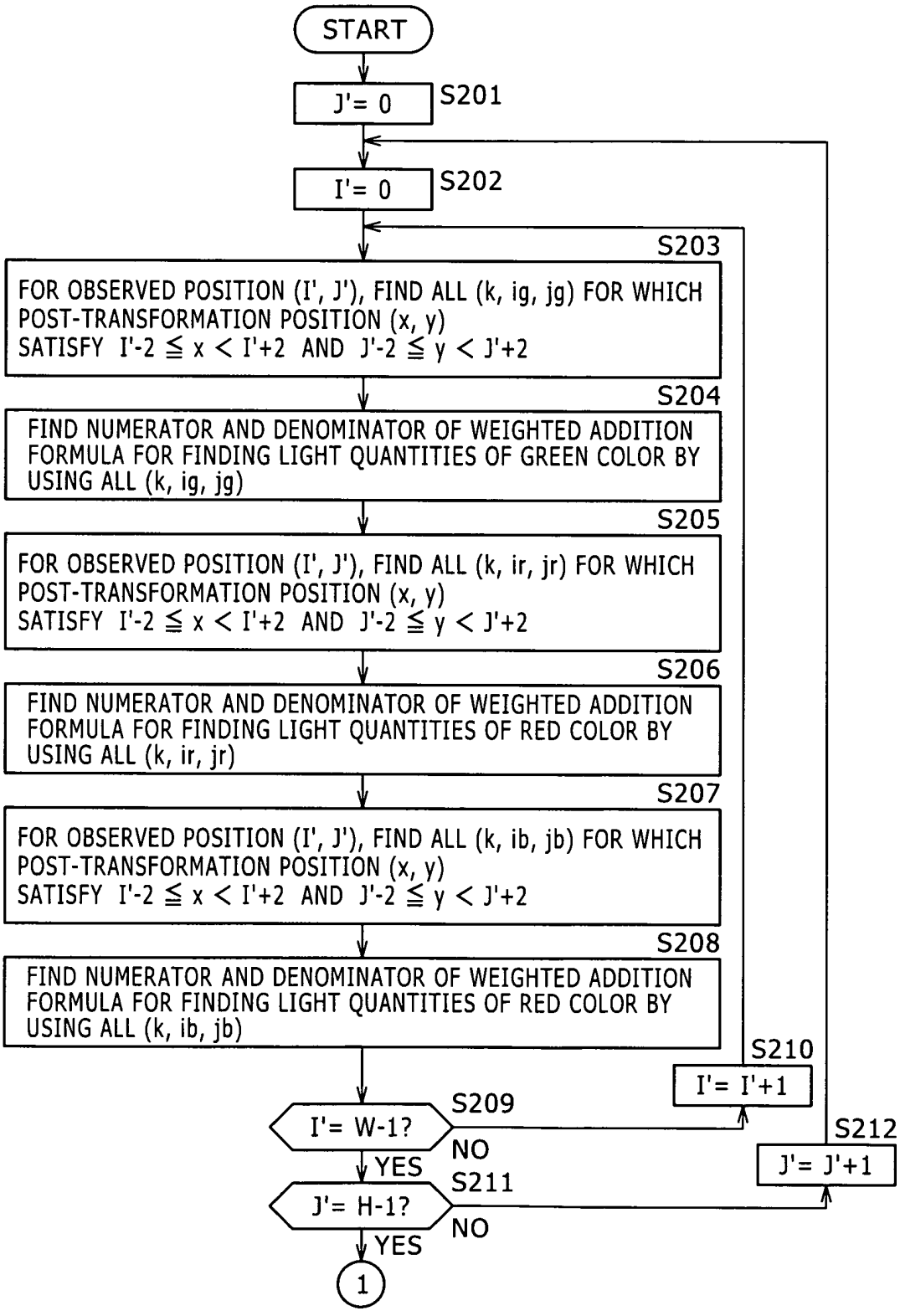

START
J'= 0
S201
I'= 0
S202
S203
FOR OBSERVED POSITION (I', J'), FIND ALL (k, ig, jg) FOR WHICH POST-TRANSFORMATION POSITION (x, y) SATISFY I'-2 ≦ x < I'+2 AND J'-2 ≦ y < J'+2
S204
FIND NUMERATOR AND DENOMINATOR OF WEIGHTED ADDITION FORMULA FOR FINDING LIGHT QUANTITIES OF GREEN COLOR BY USING ALL (k, ig, jg)
S205
FOR OBSERVED POSITION (I', J'), FIND ALL (k, ir, jr) FOR WHICH POST-TRANSFORMATION POSITION (x, y) SATISFY I'-2 ≦ x < I'+2 AND J'-2 ≦ y < J'+2
S206
FIND NUMERATOR AND DENOMINATOR OF WEIGHTED ADDITION FORMULA FOR FINDING LIGHT QUANTITIES OF RED COLOR BY USING ALL (k, ir, jr)
S207
FOR OBSERVED POSITION (I', J'), FIND ALL (k, ib, jb) FOR WHICH POST-TRANSFORMATION POSITION (x, y) SATISFY I'-2 ≦ x < I'+2 AND J'-2 ≦ y < J'+2
S208
FIND NUMERATOR AND DENOMINATOR OF WEIGHTED ADDITION FORMULA FOR FINDING LIGHT QUANTITIES OF RED COLOR BY USING ALL (k, ib, jb)
S210
I'= I'+1
S209
I'= W-1?
NO
YES
S212
J'= J'+1
S211
J'= H-1?
NO
YES
1

FIG. 21

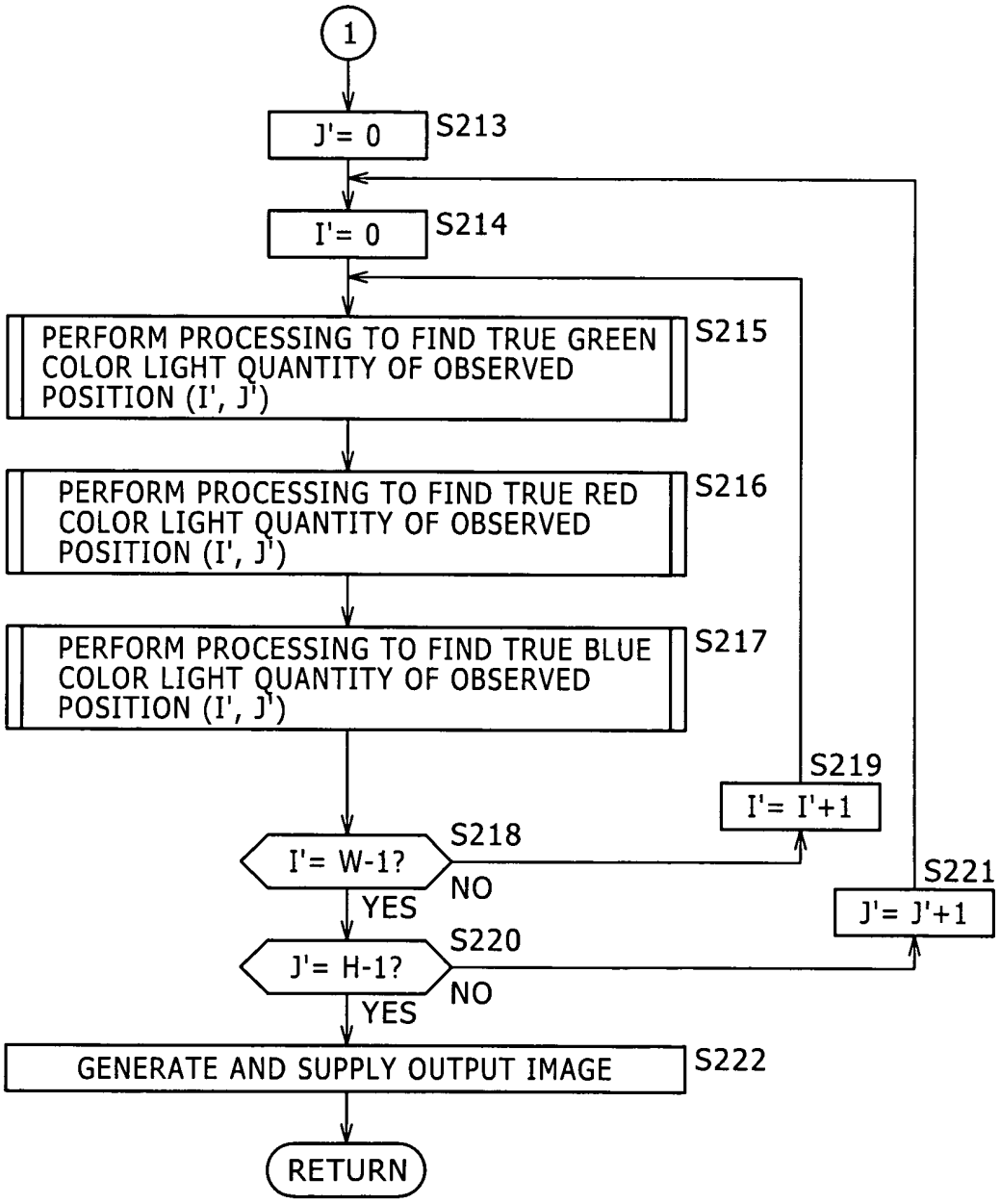

1
J'= 0
S213
I'= 0
S214
PERFORM PROCESSING TO FIND TRUE GREEN COLOR LIGHT QUANTITY OF OBSERVED POSITION (I', J')
S215
PERFORM PROCESSING TO FIND TRUE RED COLOR LIGHT QUANTITY OF OBSERVED POSITION (I', J')
S216
PERFORM PROCESSING TO FIND TRUE BLUE COLOR LIGHT QUANTITY OF OBSERVED POSITION (I', J')
S217
S219
I'= I'+1
I'= W-1?
S218
NO
YES
S221
J'= J'+1
J'= H-1?
S220
NO
YES
GENERATE AND SUPPLY OUTPUT IMAGE
S222
RETURN

FIG. 22

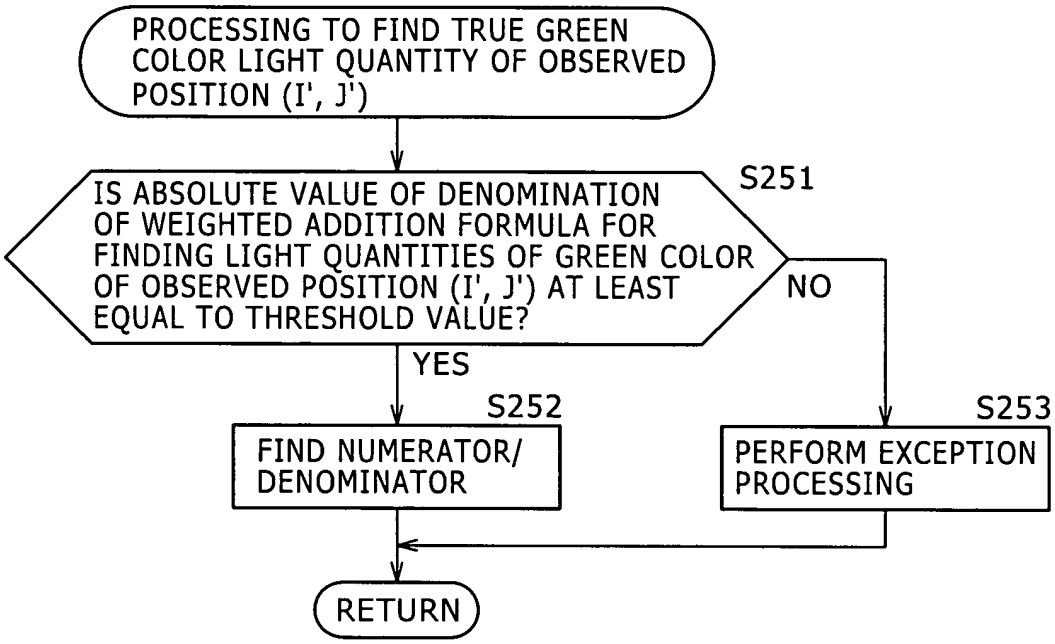

PROCESSING TO FIND TRUE GREEN COLOR LIGHT QUANTITY OF OBSERVED POSITION (I', J')
S251
IS ABSOLUTE VALUE OF DENOMINATION OF WEIGHTED ADDITION FORMULA FOR FINDING LIGHT QUANTITIES OF GREEN COLOR OF OBSERVED POSITION (I', J') AT LEAST EQUAL TO THRESHOLD VALUE?
NO
YES
S252
FIND NUMERATOR/ DENOMINATOR
S253
PERFORM EXCEPTION PROCESSING
RETURN

FIG. 23

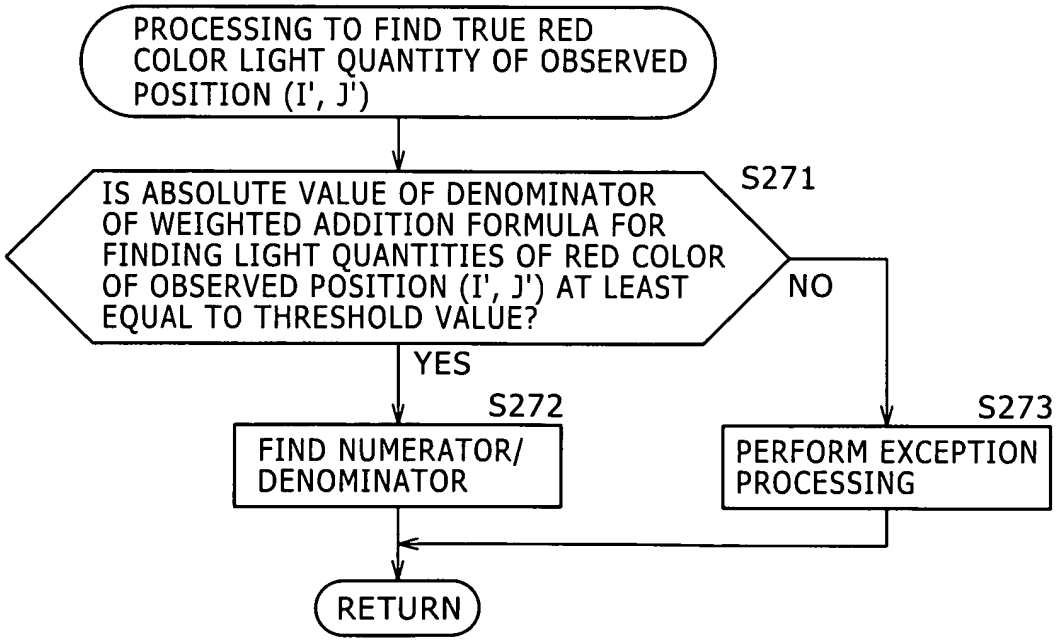

PROCESSING TO FIND TRUE RED COLOR LIGHT QUANTITY OF OBSERVED POSITION (I', J')
S271
IS ABSOLUTE VALUE OF DENOMINATOR OF WEIGHTED ADDITION FORMULA FOR FINDING LIGHT QUANTITIES OF RED COLOR OF OBSERVED POSITION (I', J') AT LEAST EQUAL TO THRESHOLD VALUE?
NO
YES
S272
FIND NUMERATOR/ DENOMINATOR
S273
PERFORM EXCEPTION PROCESSING
RETURN

FIG. 24

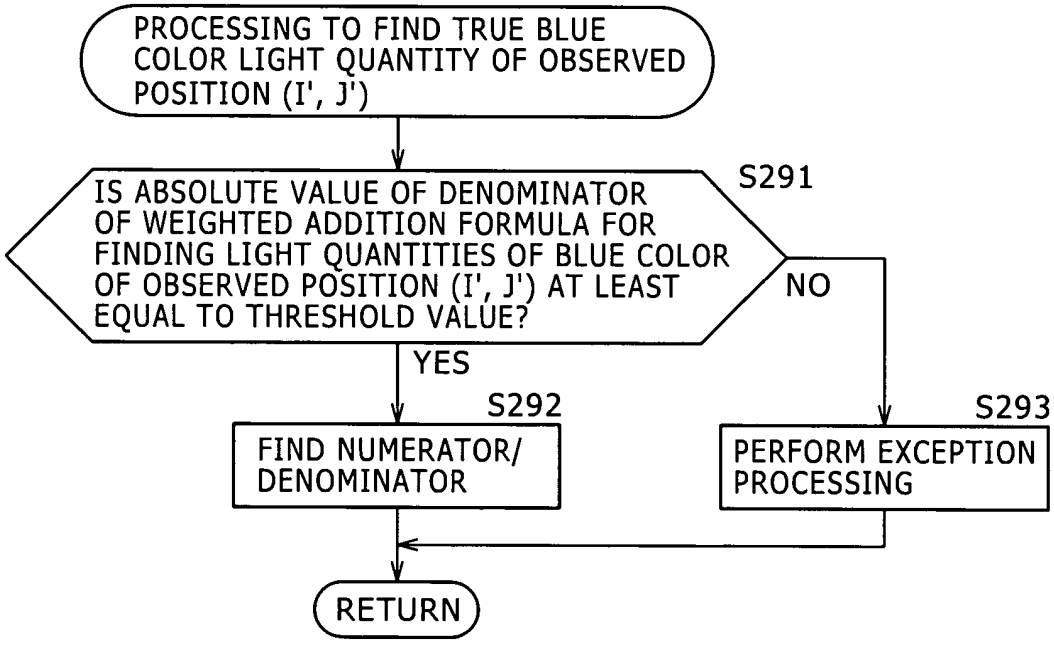

PROCESSING TO FIND TRUE BLUE COLOR LIGHT QUANTITY OF OBSERVED POSITION (I', J')
S291
IS ABSOLUTE VALUE OF DENOMINATOR OF WEIGHTED ADDITION FORMULA FOR FINDING LIGHT QUANTITIES OF BLUE COLOR OF OBSERVED POSITION (I', J') AT LEAST EQUAL TO THRESHOLD VALUE?
NO
YES
S292
FIND NUMERATOR/ DENOMINATOR
S293
PERFORM EXCEPTION PROCESSING
RETURN

FIG.25

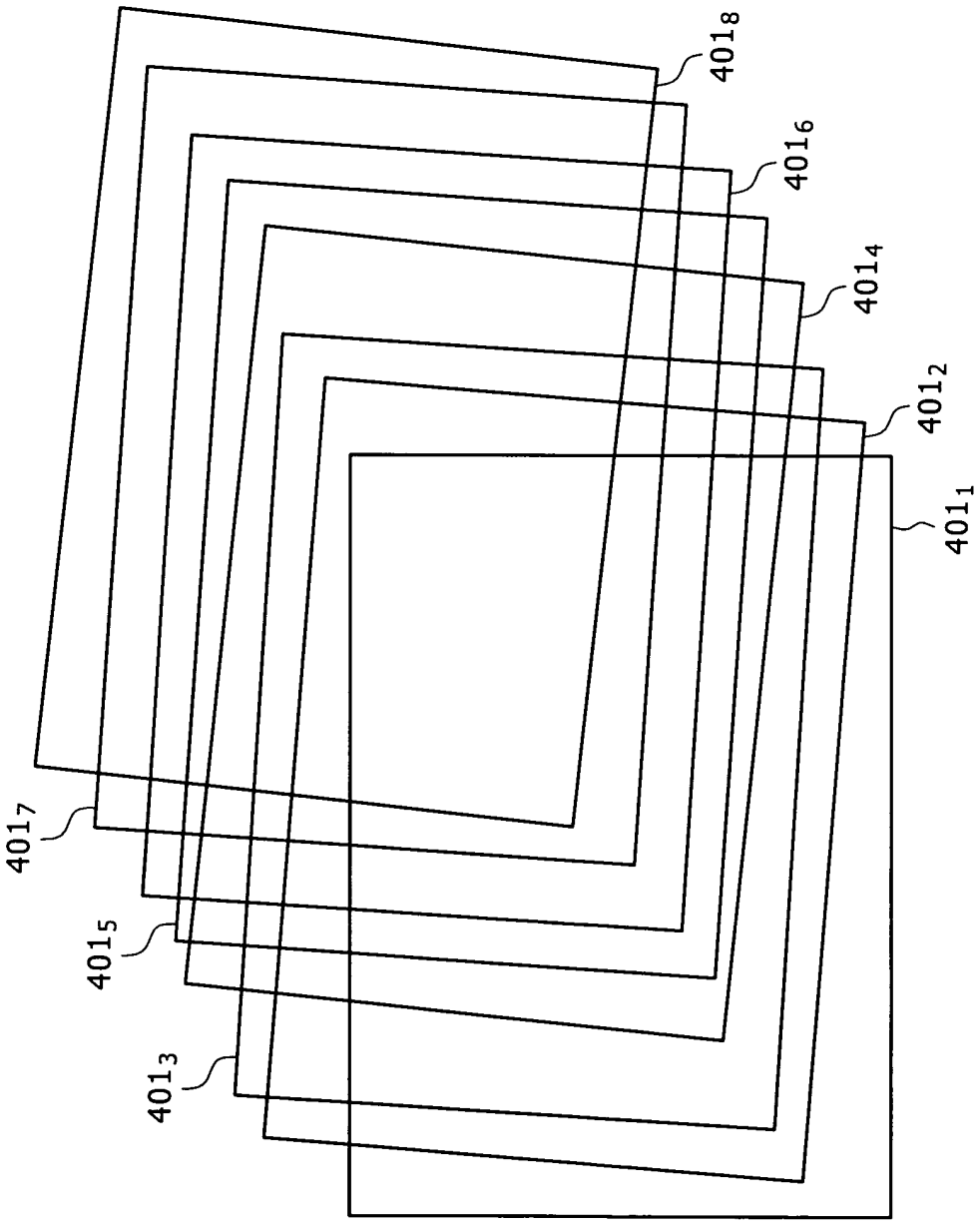


FIG.26

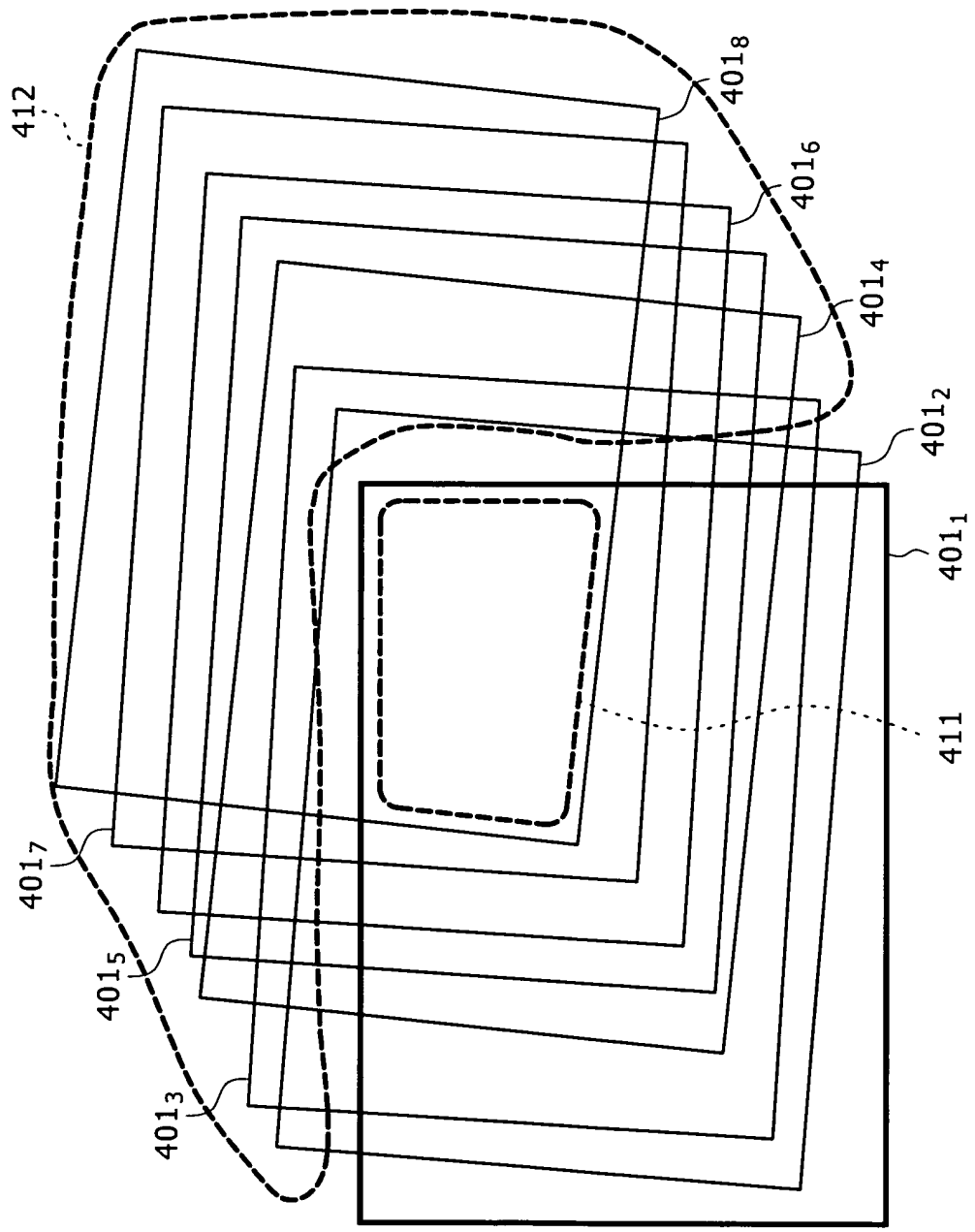


FIG.27

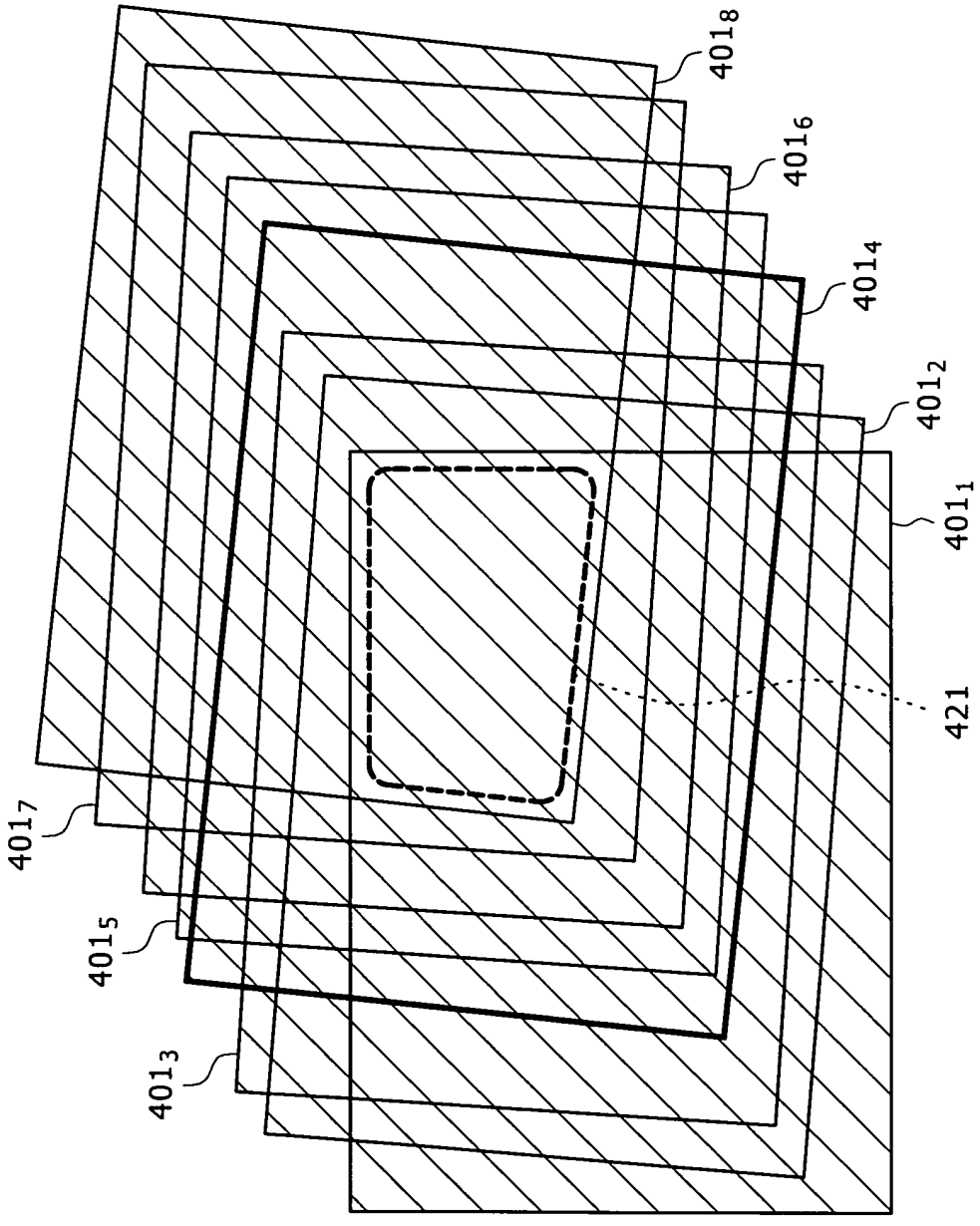


FIG. 28

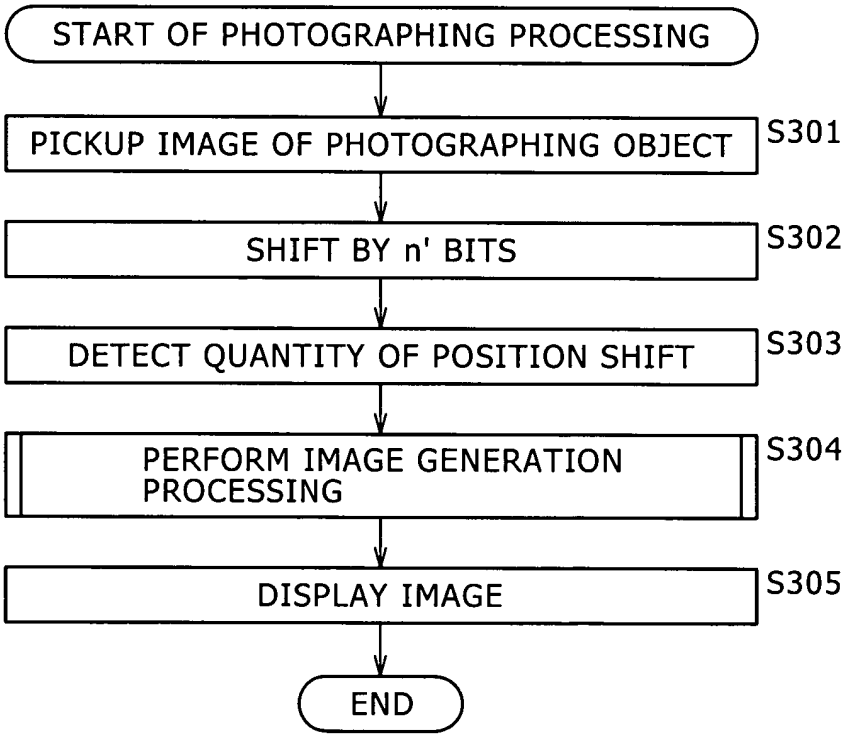

START OF PHOTOGRAPHING PROCESSING
PICKUP IMAGE OF PHOTOGRAPHING OBJECT
S301
SHIFT BY n' BITS
S302
DETECT QUANTITY OF POSITION SHIFT
S303
PERFORM IMAGE GENERATION PROCESSING
S304
DISPLAY IMAGE
S305
END

FIG. 29

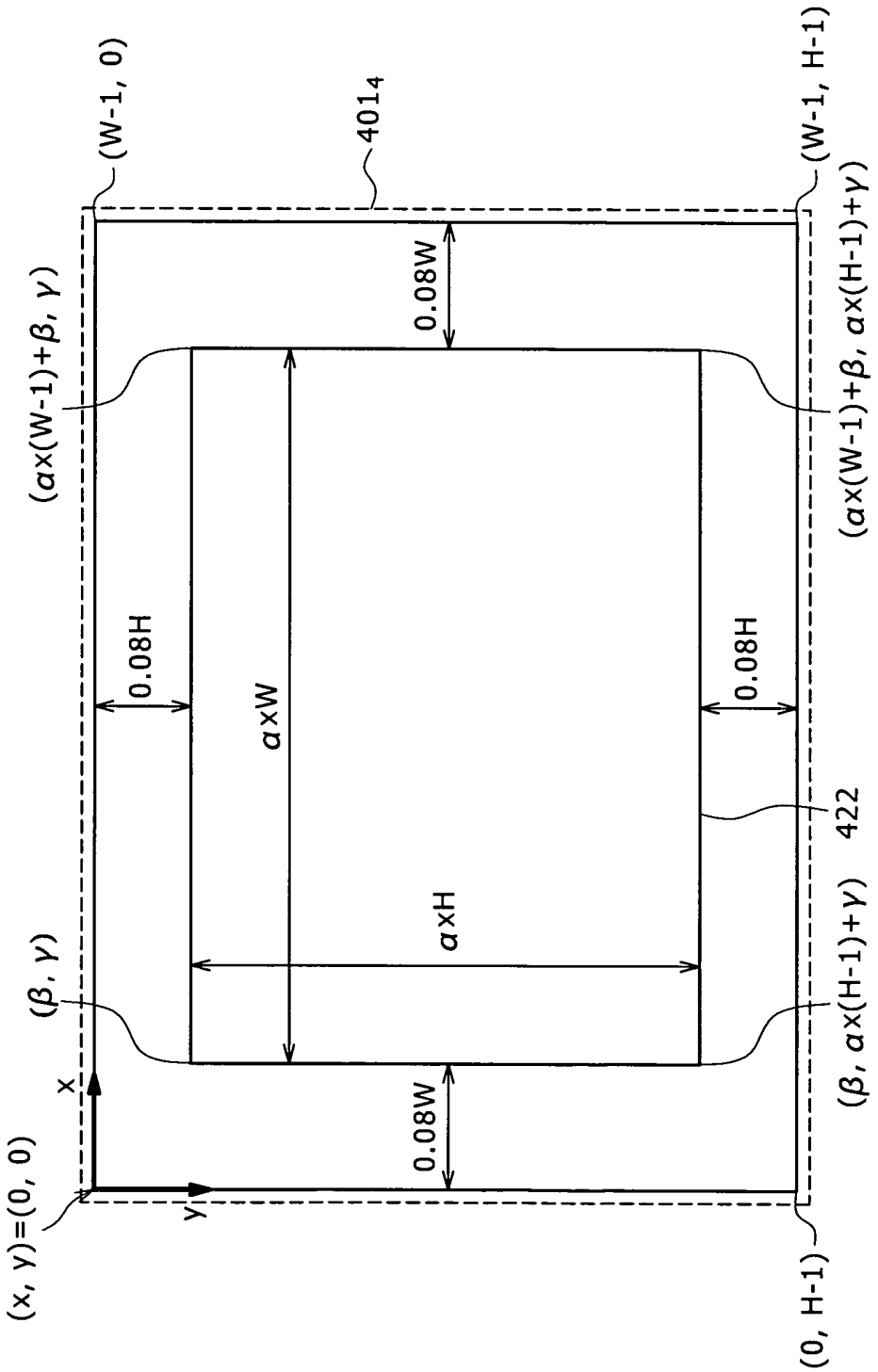

(W-1, 0)
401₄
(W-1, H-1)
(αx(W-1)+β, γ)
(αx(W-1)+β, αx(H-1)+γ)
0.08W
0.08H
αxW
0.08H
422
αxH
(β, γ)
(β, αx(H-1)+γ)
x
0.08W
(x, y)=(0, 0)
y
(0, H-1)

FIG. 30

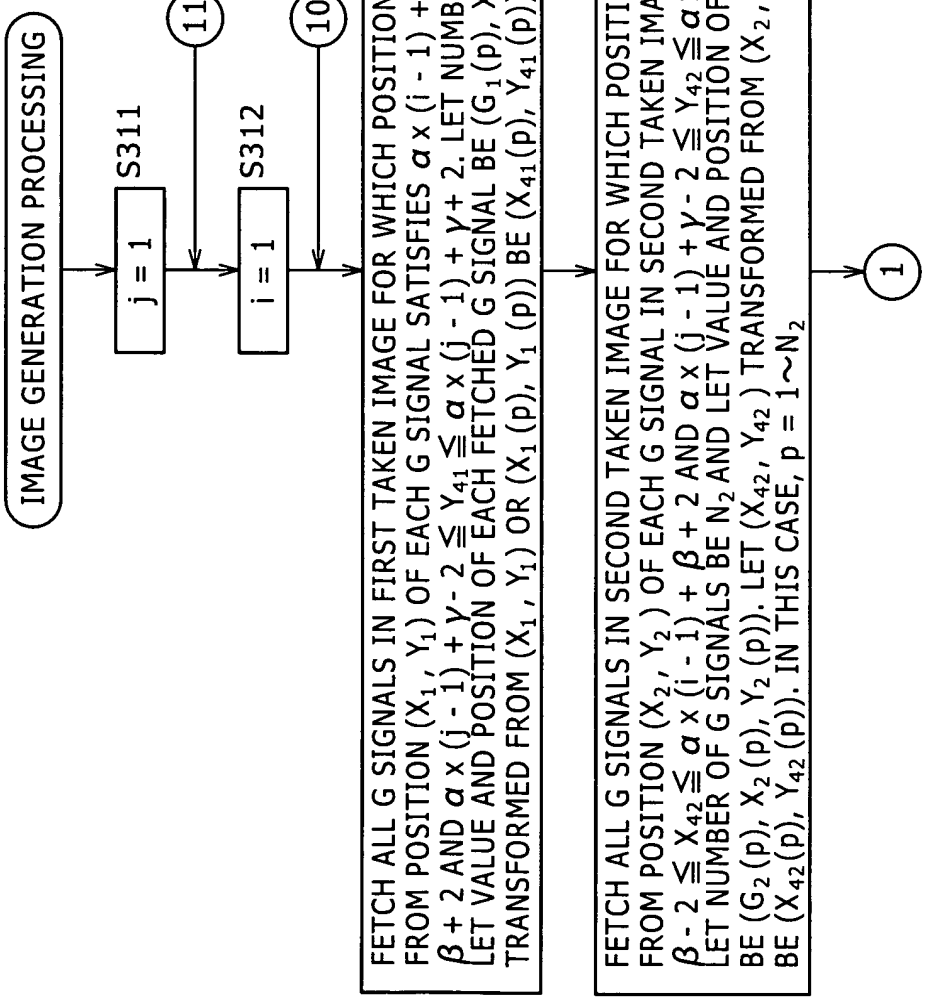


IMAGE GENERATION PROCESSING
S311
j = 1
11
S312
i = 1
10
S313
FETCH ALL G SIGNALS IN FIRST TAKEN IMAGE FOR WHICH POSITION (X_{41}, Y_{41}) TRANSFORMED FROM POSITION (X_1, Y_1) OF EACH G SIGNAL SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{41} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{41} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF G SIGNALS BE N_1 AND LET VALUE AND POSITION OF EACH FETCHED G SIGNAL BE $(G_1(p), X_1(p), Y_1(p))$. LET (X_{41}, Y_{41}) TRANSFORMED FROM (X_1, Y_1) OR $(X_1(p), Y_1(p))$ BE $(X_{41}(p), Y_{41}(p))$. IN THIS CASE, $p = 1 \sim N_1$
S314
FETCH ALL G SIGNALS IN SECOND TAKEN IMAGE FOR WHICH POSITION (X_{42}, Y_{42}) TRANSFORMED FROM POSITION (X_2, Y_2) OF EACH G SIGNAL IN SECOND TAKEN IMAGE SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{42} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{42} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF G SIGNALS BE N_2 AND LET VALUE AND POSITION OF EACH FETCHED G SIGNAL BE $(G_2(p), X_2(p), Y_2(p))$. LET (X_{42}, Y_{42}) TRANSFORMED FROM (X_2, Y_2) OR $(X_2(p), Y_2(p))$ BE $(X_{42}(p), Y_{42}(p))$. IN THIS CASE, $p = 1 \sim N_2$
1

FIG. 31

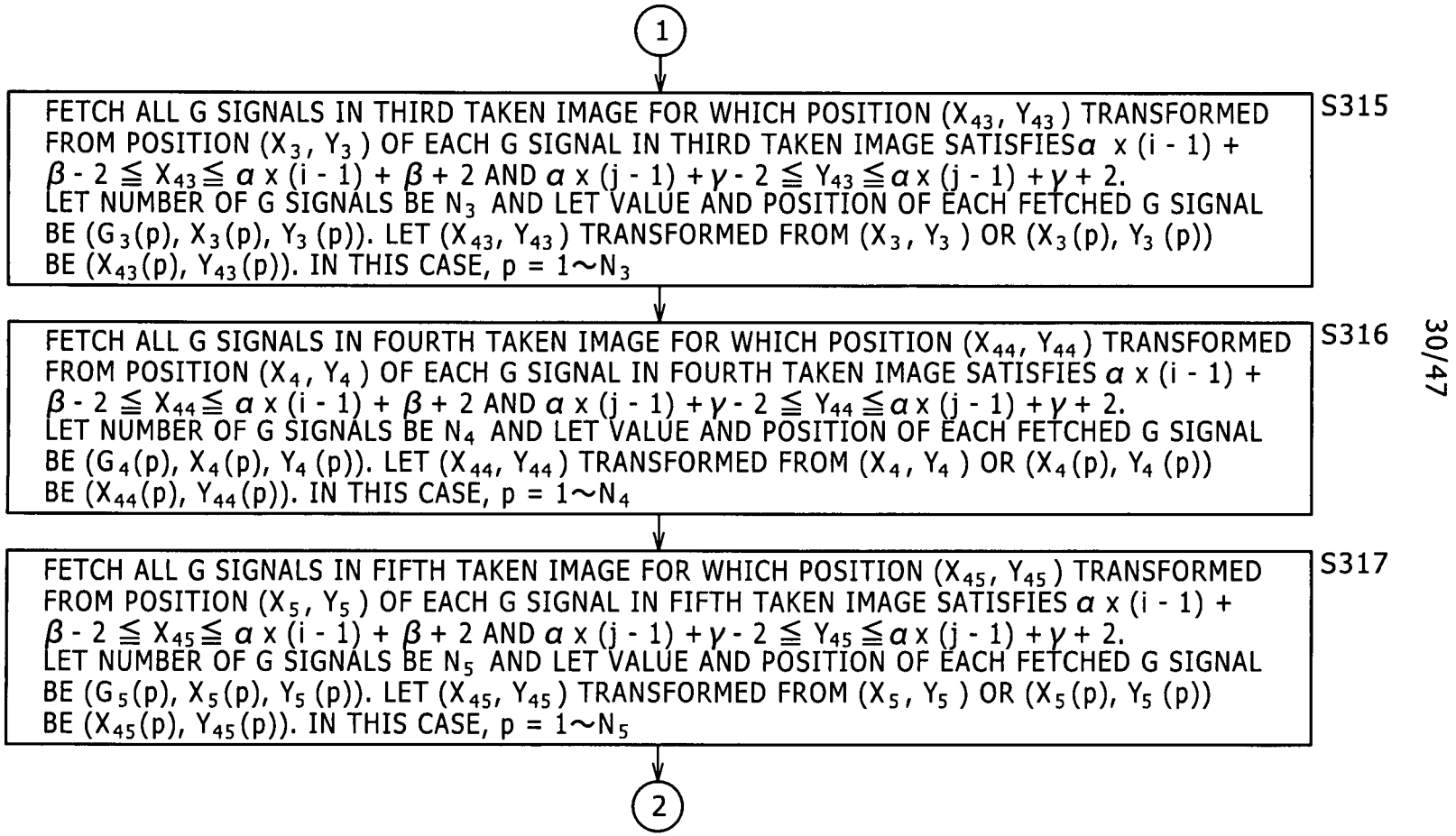

1
FETCH ALL G SIGNALS IN THIRD TAKEN IMAGE FOR WHICH POSITION (X_{43}, Y_{43}) TRANSFORMED FROM POSITION (X_3, Y_3) OF EACH G SIGNAL IN THIRD TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{43} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{43} ≦ α x (j - 1) + γ + 2. LET NUMBER OF G SIGNALS BE N_3 AND LET VALUE AND POSITION OF EACH FETCHED G SIGNAL BE ($G_3(p)$, $X_3(p)$, $Y_3(p)$). LET (X_{43}, Y_{43}) TRANSFORMED FROM (X_3, Y_3) OR ($X_3(p)$, $Y_3(p)$) BE ($X_{43}(p)$, $Y_{43}(p)$). IN THIS CASE, p = 1∼N_3
S315
FETCH ALL G SIGNALS IN FOURTH TAKEN IMAGE FOR WHICH POSITION (X_{44}, Y_{44}) TRANSFORMED FROM POSITION (X_4, Y_4) OF EACH G SIGNAL IN FOURTH TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{44} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{44} ≦ α x (j - 1) + γ + 2. LET NUMBER OF G SIGNALS BE N_4 AND LET VALUE AND POSITION OF EACH FETCHED G SIGNAL BE ($G_4(p)$, $X_4(p)$, $Y_4(p)$). LET (X_{44}, Y_{44}) TRANSFORMED FROM (X_4, Y_4) OR ($X_4(p)$, $Y_4(p)$) BE ($X_{44}(p)$, $Y_{44}(p)$). IN THIS CASE, p = 1∼N_4
S316
FETCH ALL G SIGNALS IN FIFTH TAKEN IMAGE FOR WHICH POSITION (X_{45}, Y_{45}) TRANSFORMED FROM POSITION (X_5, Y_5) OF EACH G SIGNAL IN FIFTH TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{45} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{45} ≦ α x (j - 1) + γ + 2. LET NUMBER OF G SIGNALS BE N_5 AND LET VALUE AND POSITION OF EACH FETCHED G SIGNAL BE ($G_5(p)$, $X_5(p)$, $Y_5(p)$). LET (X_{45}, Y_{45}) TRANSFORMED FROM (X_5, Y_5) OR ($X_5(p)$, $Y_5(p)$) BE ($X_{45}(p)$, $Y_{45}(p)$). IN THIS CASE, p = 1∼N_5
S317
2

FIG. 32

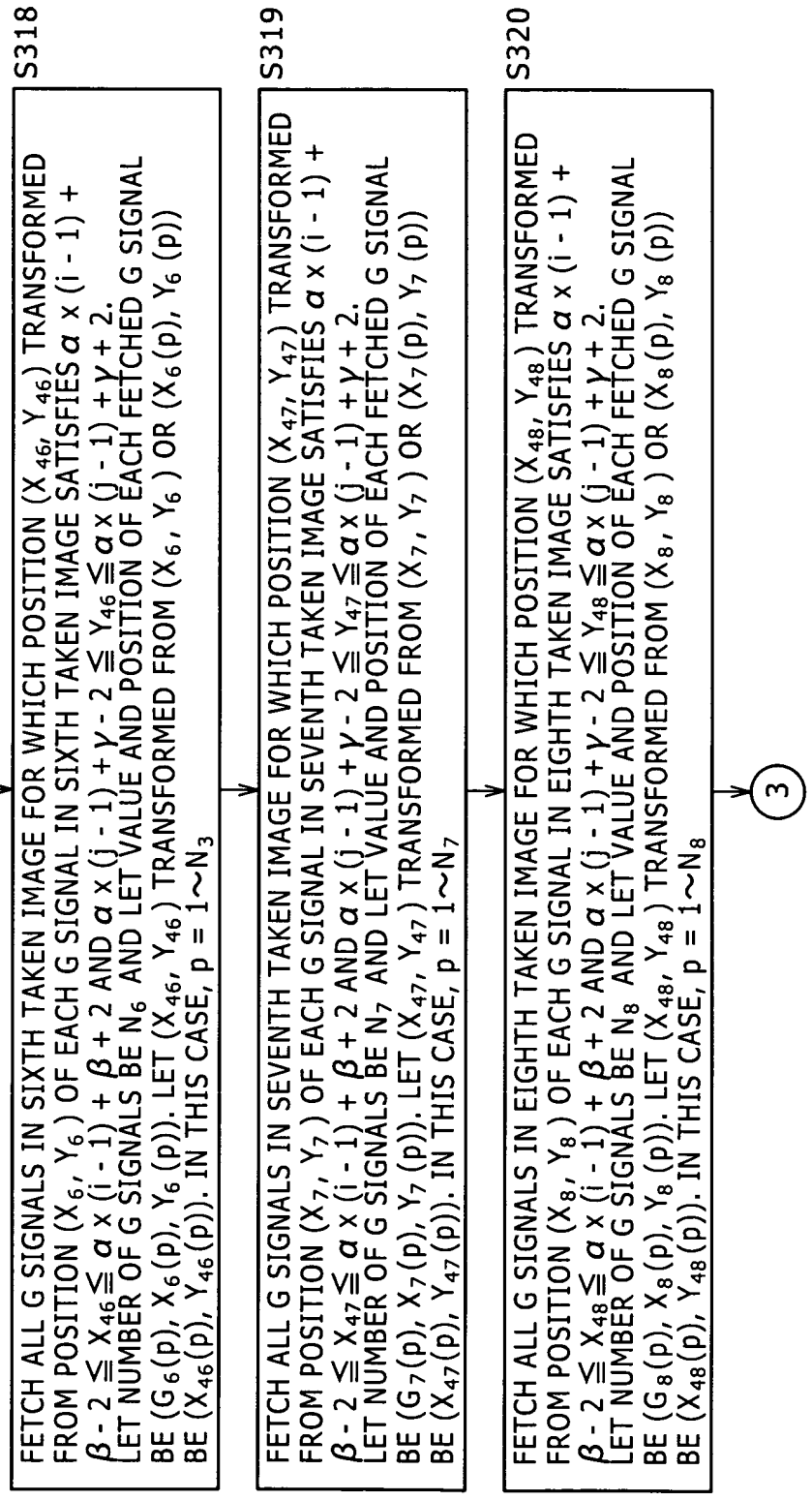

2
S318
FETCH ALL G SIGNALS IN SIXTH TAKEN IMAGE FOR WHICH POSITION (X_{46}, Y_{46}) TRANSFORMED FROM POSITION (X_6, Y_6) OF EACH G SIGNAL IN SIXTH TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{46} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{46} ≦ α x (j - 1) + γ + 2. LET NUMBER OF G SIGNALS BE N_6 AND LET VALUE AND POSITION OF EACH FETCHED G SIGNAL BE (G_6(p), X_6(p), Y_6(p)). LET (X_{46}, Y_{46}) TRANSFORMED FROM (X_6, Y_6) OR (X_6(p), Y_6(p)) BE (X_{46}(p), Y_{46}(p)). IN THIS CASE, p = 1~N_3
S319
FETCH ALL G SIGNALS IN SEVENTH TAKEN IMAGE FOR WHICH POSITION (X_{47}, Y_{47}) TRANSFORMED FROM POSITION (X_7, Y_7) OF EACH G SIGNAL IN SEVENTH TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{47} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{47} ≦ α x (j - 1) + γ + 2. LET NUMBER OF G SIGNALS BE N_7 AND LET VALUE AND POSITION OF EACH FETCHED G SIGNAL BE (G_7(p), X_7(p), Y_7(p)). LET (X_{47}, Y_{47}) TRANSFORMED FROM (X_7, Y_7) OR (X_7(p), Y_7(p)) BE (X_{47}(p), Y_{47}(p)). IN THIS CASE, p = 1~N_7
S320
FETCH ALL G SIGNALS IN EIGHTH TAKEN IMAGE FOR WHICH POSITION (X_{48}, Y_{48}) TRANSFORMED FROM POSITION (X_8, Y_8) OF EACH G SIGNAL IN EIGHTH TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{48} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{48} ≦ α x (j - 1) + γ + 2. LET NUMBER OF G SIGNALS BE N_8 AND LET VALUE AND POSITION OF EACH FETCHED G SIGNAL BE (G_8(p), X_8(p), Y_8(p)). LET (X_{48}, Y_{48}) TRANSFORMED FROM (X_8, Y_8) OR (X_8(p), Y_8(p)) BE (X_{48}(p), Y_{48}(p)). IN THIS CASE, p = 1~N_8
3

FIG. 33

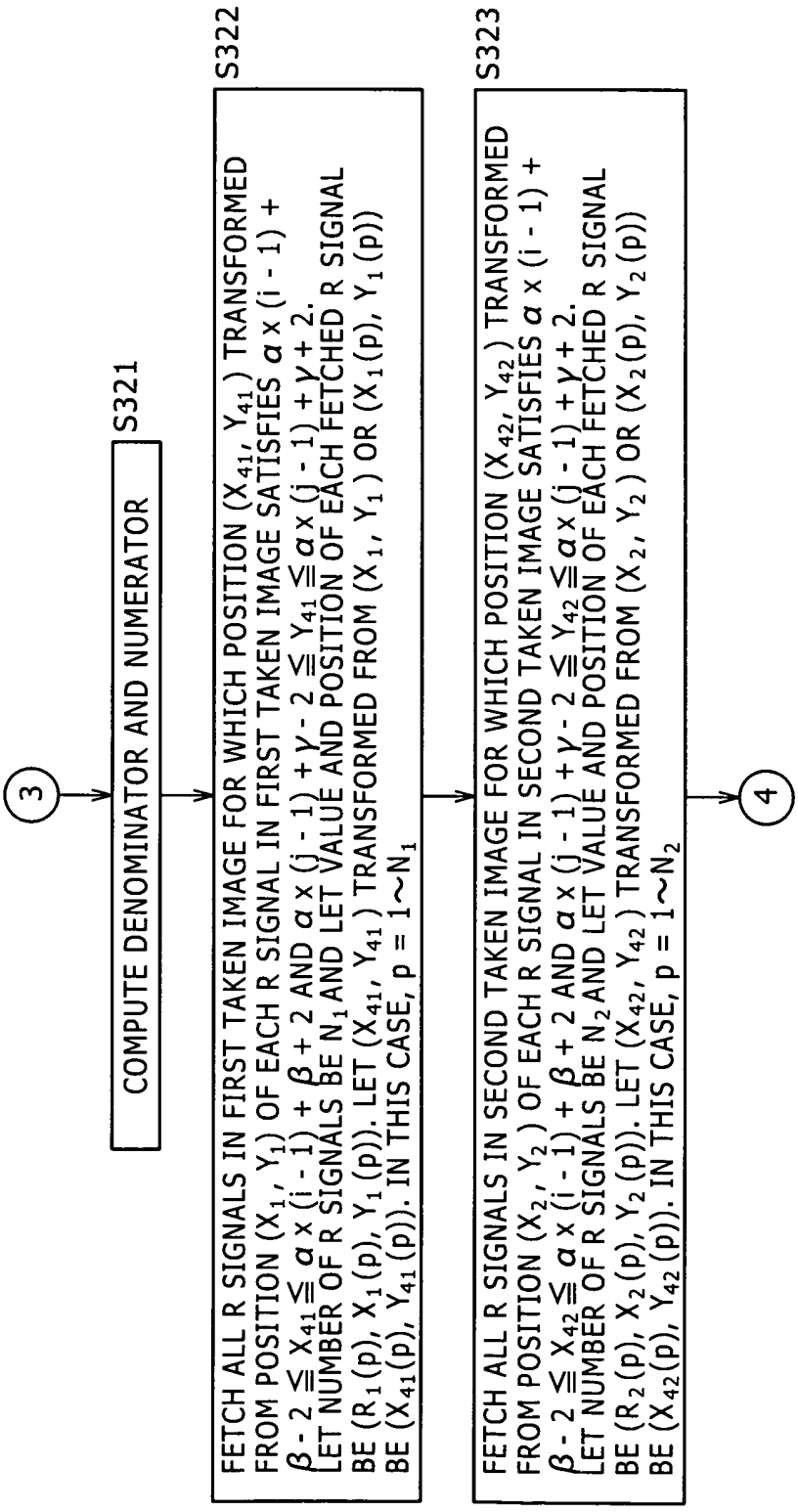

3
COMPUTE DENOMINATOR AND NUMERATOR
S321
FETCH ALL R SIGNALS IN FIRST TAKEN IMAGE FOR WHICH POSITION (X_{41}, Y_{41}) TRANSFORMED FROM POSITION (X_1, Y_1) OF EACH R SIGNAL IN FIRST TAKEN IMAGE SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{41} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{41} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF R SIGNALS BE N_1 AND LET VALUE AND POSITION OF EACH FETCHED R SIGNAL BE ($R_1(p)$, $X_1(p)$, $Y_1(p)$). LET (X_{41}, Y_{41}) TRANSFORMED FROM (X_1, Y_1) OR ($X_1(p)$, $Y_1(p)$) BE ($X_{41}(p)$, $Y_{41}(p)$). IN THIS CASE, $p = 1 \sim N_1$
S322
FETCH ALL R SIGNALS IN SECOND TAKEN IMAGE FOR WHICH POSITION (X_{42}, Y_{42}) TRANSFORMED FROM POSITION (X_2, Y_2) OF EACH R SIGNAL IN SECOND TAKEN IMAGE SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{42} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{42} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF R SIGNALS BE N_2 AND LET VALUE AND POSITION OF EACH FETCHED R SIGNAL BE ($R_2(p)$, $X_2(p)$, $Y_2(p)$). LET (X_{42}, Y_{42}) TRANSFORMED FROM (X_2, Y_2) OR ($X_2(p)$, $Y_2(p)$) BE ($X_{42}(p)$, $Y_{42}(p)$). IN THIS CASE, $p = 1 \sim N_2$
S323
4

FIG. 34

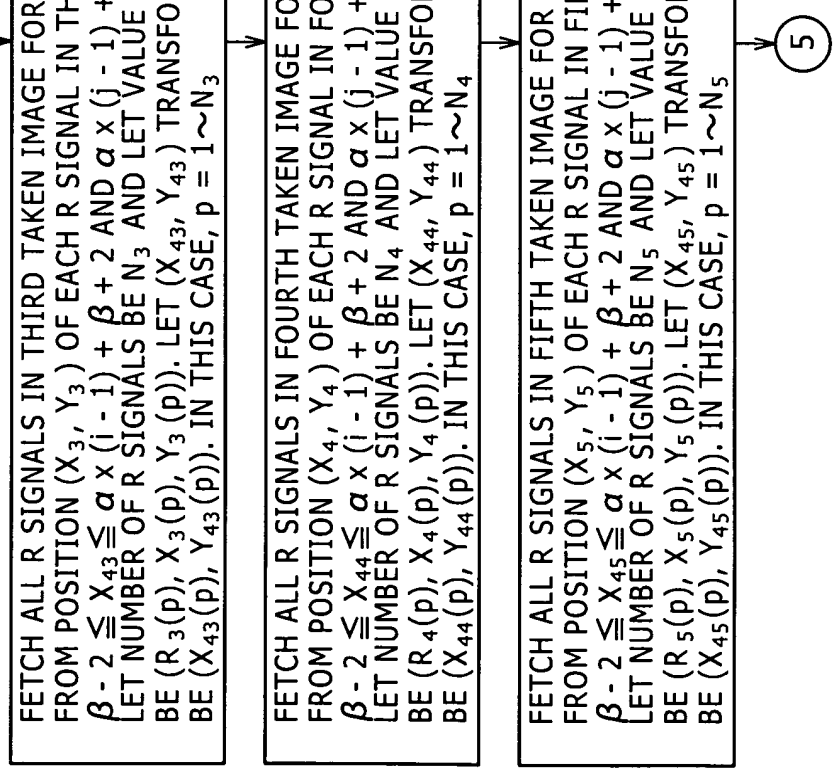

4
S324
FETCH ALL R SIGNALS IN THIRD TAKEN IMAGE FOR WHICH POSITION (X_{43}, Y_{43}) TRANSFORMED FROM POSITION (X_3, Y_3) OF EACH R SIGNAL IN THIRD TAKEN IMAGE SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{43} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{43} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF R SIGNALS BE N_3 AND LET VALUE AND POSITION OF EACH FETCHED R SIGNAL BE ($R_3(p)$, $X_3(p)$, $Y_3(p)$). LET (X_{43}, Y_{43}) TRANSFORMED FROM (X_3, Y_3) OR ($X_3(p)$, $Y_3(p)$) BE ($X_{43}(p)$, $Y_{43}(p)$). IN THIS CASE, $p = 1 \sim N_3$
S325
FETCH ALL R SIGNALS IN FOURTH TAKEN IMAGE FOR WHICH POSITION (X_{44}, Y_{44}) TRANSFORMED FROM POSITION (X_4, Y_4) OF EACH R SIGNAL IN FOURTH TAKEN IMAGE SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{44} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{44} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF R SIGNALS BE N_4 AND LET VALUE AND POSITION OF EACH FETCHED R SIGNAL BE ($R_4(p)$, $X_4(p)$, $Y_4(p)$). LET (X_{44}, Y_{44}) TRANSFORMED FROM (X_4, Y_4) OR ($X_4(p)$, $Y_4(p)$) BE ($X_{44}(p)$, $Y_{44}(p)$). IN THIS CASE, $p = 1 \sim N_4$
S326
FETCH ALL R SIGNALS IN FIFTH TAKEN IMAGE FOR WHICH POSITION (X_{45}, Y_{45}) TRANSFORMED FROM POSITION (X_5, Y_5) OF EACH R SIGNAL IN FIFTH TAKEN IMAGE SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{45} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{45} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF R SIGNALS BE N_5 AND LET VALUE AND POSITION OF EACH FETCHED R SIGNAL BE ($R_5(p)$, $X_5(p)$, $Y_5(p)$). LET (X_{45}, Y_{45}) TRANSFORMED FROM (X_5, Y_5) OR ($X_5(p)$, $Y_5(p)$) BE ($X_{45}(p)$, $Y_{45}(p)$). IN THIS CASE, $p = 1 \sim N_5$
5

FIG. 35

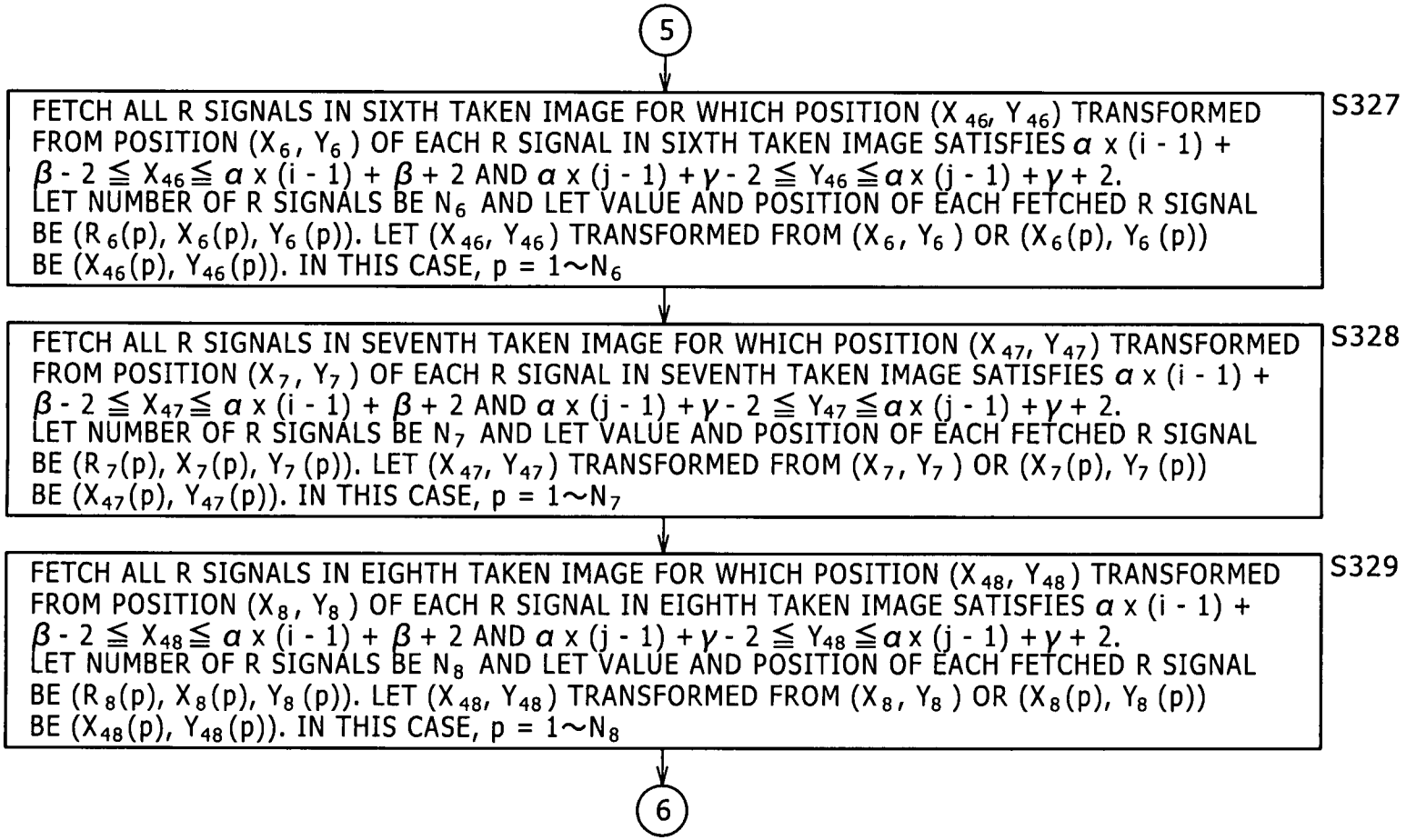

5
FETCH ALL R SIGNALS IN SIXTH TAKEN IMAGE FOR WHICH POSITION (X_{46}, Y_{46}) TRANSFORMED FROM POSITION (X_6, Y_6) OF EACH R SIGNAL IN SIXTH TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{46} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{46} ≦ α x (j - 1) + γ + 2. LET NUMBER OF R SIGNALS BE N_6 AND LET VALUE AND POSITION OF EACH FETCHED R SIGNAL BE ($R_6(p)$, $X_6(p)$, $Y_6(p)$). LET (X_{46}, Y_{46}) TRANSFORMED FROM (X_6, Y_6) OR ($X_6(p)$, $Y_6(p)$) BE ($X_{46}(p)$, $Y_{46}(p)$). IN THIS CASE, p = 1∼N_6
S327
FETCH ALL R SIGNALS IN SEVENTH TAKEN IMAGE FOR WHICH POSITION (X_{47}, Y_{47}) TRANSFORMED FROM POSITION (X_7, Y_7) OF EACH R SIGNAL IN SEVENTH TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{47} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{47} ≦ α x (j - 1) + γ + 2. LET NUMBER OF R SIGNALS BE N_7 AND LET VALUE AND POSITION OF EACH FETCHED R SIGNAL BE ($R_7(p)$, $X_7(p)$, $Y_7(p)$). LET (X_{47}, Y_{47}) TRANSFORMED FROM (X_7, Y_7) OR ($X_7(p)$, $Y_7(p)$) BE ($X_{47}(p)$, $Y_{47}(p)$). IN THIS CASE, p = 1∼N_7
S328
FETCH ALL R SIGNALS IN EIGHTH TAKEN IMAGE FOR WHICH POSITION (X_{48}, Y_{48}) TRANSFORMED FROM POSITION (X_8, Y_8) OF EACH R SIGNAL IN EIGHTH TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{48} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{48} ≦ α x (j - 1) + γ + 2. LET NUMBER OF R SIGNALS BE N_8 AND LET VALUE AND POSITION OF EACH FETCHED R SIGNAL BE ($R_8(p)$, $X_8(p)$, $Y_8(p)$). LET (X_{48}, Y_{48}) TRANSFORMED FROM (X_8, Y_8) OR ($X_8(p)$, $Y_8(p)$) BE ($X_{48}(p)$, $Y_{48}(p)$). IN THIS CASE, p = 1∼N_8
S329
6

FIG. 36

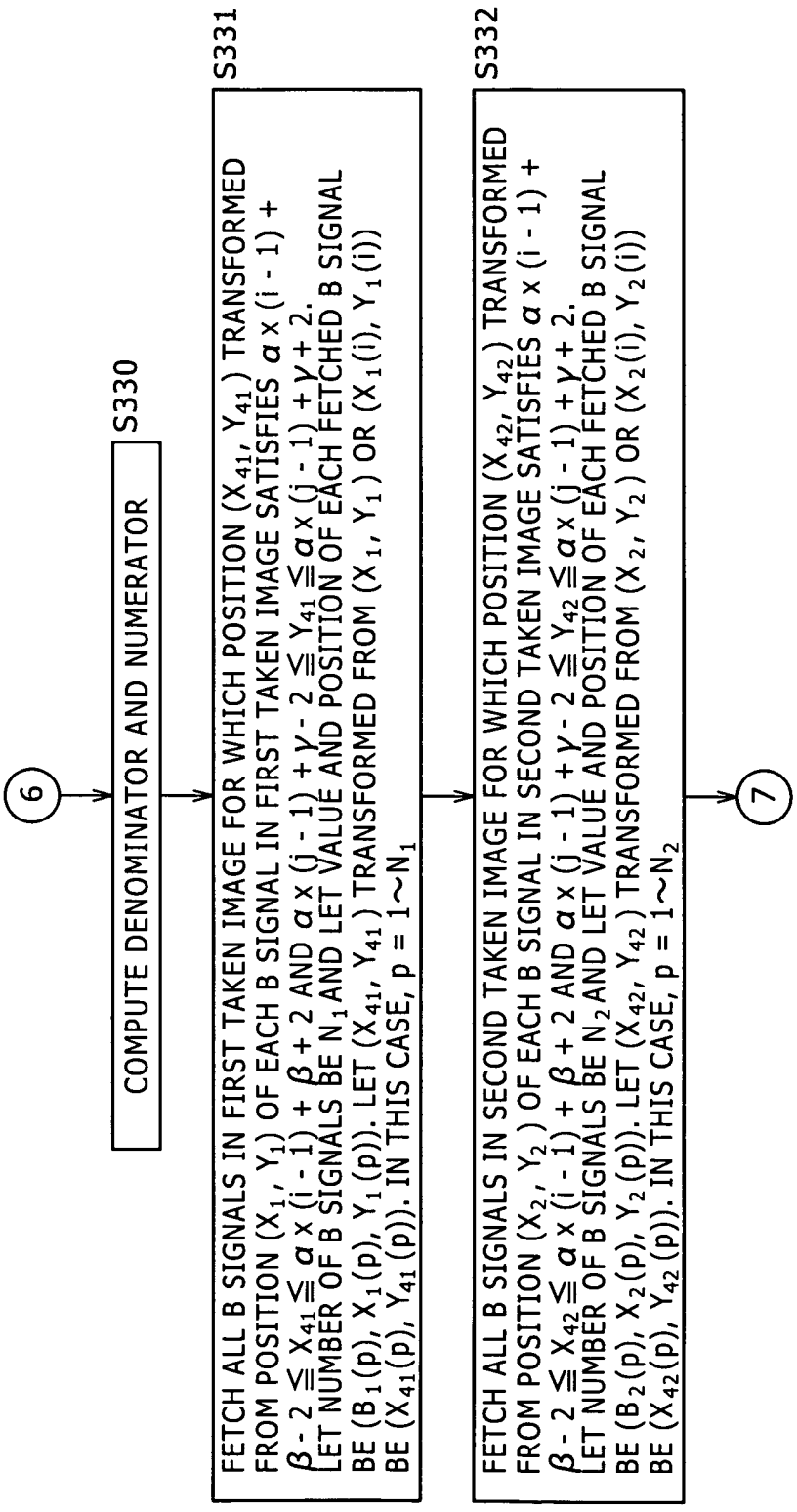

6
COMPUTE DENOMINATOR AND NUMERATOR
S330
FETCH ALL B SIGNALS IN FIRST TAKEN IMAGE FOR WHICH POSITION (X_{41}, Y_{41}) TRANSFORMED FROM POSITION (X_1, Y_1) OF EACH B SIGNAL IN FIRST TAKEN IMAGE SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{41} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{41} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF B SIGNALS BE N_1 AND LET VALUE AND POSITION OF EACH FETCHED B SIGNAL BE ($B_1(p)$, $X_1(p)$, $Y_1(p)$). LET (X_{41}, Y_{41}) TRANSFORMED FROM (X_1, Y_1) OR ($X_1(i)$, $Y_1(i)$) BE ($X_{41}(p)$, $Y_{41}(p)$). IN THIS CASE, $p = 1 \sim N_1$
S331
FETCH ALL B SIGNALS IN SECOND TAKEN IMAGE FOR WHICH POSITION (X_{42}, Y_{42}) TRANSFORMED FROM POSITION (X_2, Y_2) OF EACH B SIGNAL IN SECOND TAKEN IMAGE SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{42} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{42} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF B SIGNALS BE N_2 AND LET VALUE AND POSITION OF EACH FETCHED B SIGNAL BE ($B_2(p)$, $X_2(p)$, $Y_2(p)$). LET (X_{42}, Y_{42}) TRANSFORMED FROM (X_2, Y_2) OR ($X_2(i)$, $Y_2(i)$) BE ($X_{42}(p)$, $Y_{42}(p)$). IN THIS CASE, $p = 1 \sim N_2$
S332
7

FIG. 37

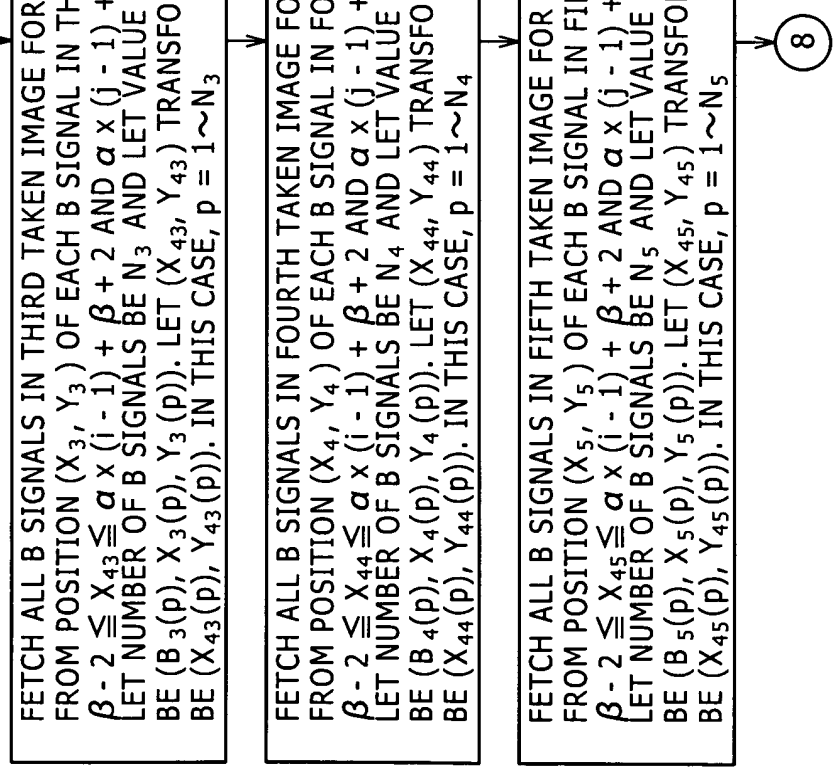

7
S333
FETCH ALL B SIGNALS IN THIRD TAKEN IMAGE FOR WHICH POSITION (X_{43}, Y_{43}) TRANSFORMED FROM POSITION (X_3, Y_3) OF EACH B SIGNAL IN THIRD TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{43} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{43} ≦ α x (j - 1) + γ + 2. LET NUMBER OF B SIGNALS BE N_3 AND LET VALUE AND POSITION OF EACH FETCHED B SIGNAL BE (B_3(p), X_3(p), Y_3(p)). LET (X_{43}, Y_{43}) TRANSFORMED FROM (X_3, Y_3) OR (X_3(p), Y_3(p)) BE (X_{43}(p), Y_{43}(p)). IN THIS CASE, p = 1~N_3
S334
FETCH ALL B SIGNALS IN FOURTH TAKEN IMAGE FOR WHICH POSITION (X_{44}, Y_{44}) TRANSFORMED FROM POSITION (X_4, Y_4) OF EACH B SIGNAL IN FOURTH TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{44} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{44} ≦ α x (j - 1) + γ + 2. LET NUMBER OF B SIGNALS BE N_4 AND LET VALUE AND POSITION OF EACH FETCHED B SIGNAL BE (B_4(p), X_4(p), Y_4(p)). LET (X_{44}, Y_{44}) TRANSFORMED FROM (X_4, Y_4) OR (X_4(p), Y_4(p)) BE (X_{44}(p), Y_{44}(p)). IN THIS CASE, p = 1~N_4
S335
FETCH ALL B SIGNALS IN FIFTH TAKEN IMAGE FOR WHICH POSITION (X_{45}, Y_{45}) TRANSFORMED FROM POSITION (X_5, Y_5) OF EACH B SIGNAL IN FIFTH TAKEN IMAGE SATISFIES α x (i - 1) + β - 2 ≦ X_{45} ≦ α x (i - 1) + β + 2 AND α x (j - 1) + γ - 2 ≦ Y_{45} ≦ α x (j - 1) + γ + 2. LET NUMBER OF B SIGNALS BE N_5 AND LET VALUE AND POSITION OF EACH FETCHED B SIGNAL BE (B_5(p), X_5(p), Y_5(p)). LET (X_{45}, Y_{45}) TRANSFORMED FROM (X_5, Y_5) OR (X_5(p), Y_5(p)) BE (X_{45}(p), Y_{45}(p)). IN THIS CASE, p = 1~N_5
8

FIG. 38

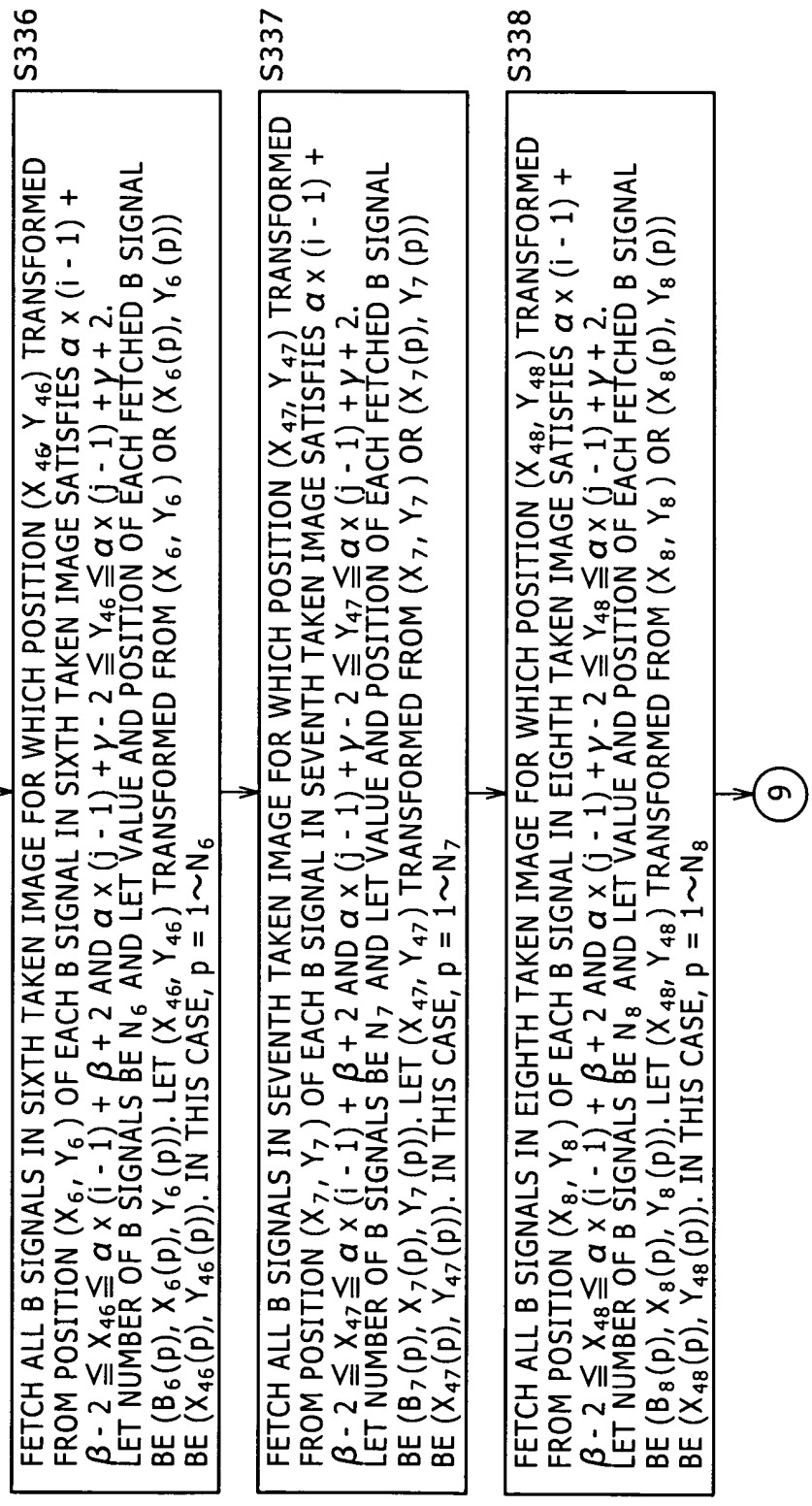

8
FETCH ALL B SIGNALS IN SIXTH TAKEN IMAGE FOR WHICH POSITION (X_{46}, Y_{46}) TRANSFORMED FROM POSITION (X_6, Y_6) OF EACH B SIGNAL IN SIXTH TAKEN IMAGE SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{46} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{46} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF B SIGNALS BE N_6 AND LET VALUE AND POSITION OF EACH FETCHED B SIGNAL BE ($B_6(p)$, $X_6(p)$, $Y_6(p)$). LET (X_{46}, Y_{46}) TRANSFORMED FROM (X_6, Y_6) OR ($X_6(p)$, $Y_6(p)$) BE ($X_{46}(p)$, $Y_{46}(p)$). IN THIS CASE, $p = 1 \sim N_6$
S336
FETCH ALL B SIGNALS IN SEVENTH TAKEN IMAGE FOR WHICH POSITION (X_{47}, Y_{47}) TRANSFORMED FROM POSITION (X_7, Y_7) OF EACH B SIGNAL IN SEVENTH TAKEN IMAGE SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{47} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{47} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF B SIGNALS BE N_7 AND LET VALUE AND POSITION OF EACH FETCHED B SIGNAL BE ($B_7(p)$, $X_7(p)$, $Y_7(p)$). LET (X_{47}, Y_{47}) TRANSFORMED FROM (X_7, Y_7) OR ($X_7(p)$, $Y_7(p)$) BE ($X_{47}(p)$, $Y_{47}(p)$). IN THIS CASE, $p = 1 \sim N_7$
S337
FETCH ALL B SIGNALS IN EIGHTH TAKEN IMAGE FOR WHICH POSITION (X_{48}, Y_{48}) TRANSFORMED FROM POSITION (X_8, Y_8) OF EACH B SIGNAL IN EIGHTH TAKEN IMAGE SATISFIES $\alpha \times (i - 1) + \beta - 2 \leqq X_{48} \leqq \alpha \times (i - 1) + \beta + 2$ AND $\alpha \times (j - 1) + \gamma - 2 \leqq Y_{48} \leqq \alpha \times (j - 1) + \gamma + 2$. LET NUMBER OF B SIGNALS BE N_8 AND LET VALUE AND POSITION OF EACH FETCHED B SIGNAL BE ($B_8(p)$, $X_8(p)$, $Y_8(p)$). LET (X_{48}, Y_{48}) TRANSFORMED FROM (X_8, Y_8) OR ($X_8(p)$, $Y_8(p)$) BE ($X_{48}(p)$, $Y_{48}(p)$). IN THIS CASE, $p = 1 \sim N_8$
S338
9

FIG. 39

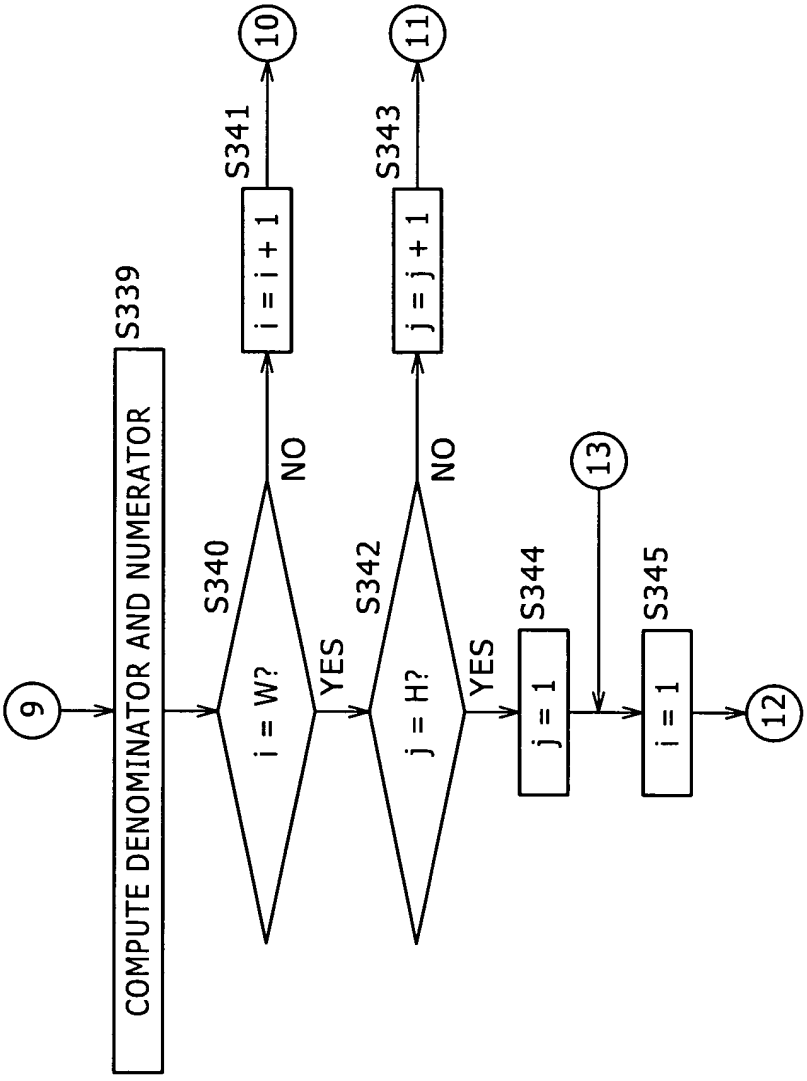

9
S339
COMPUTE DENOMINATOR AND NUMERATOR
S340
i = W?
YES
NO
S341
i = i + 1
10
S342
j = H?
YES
NO
S343
j = j + 1
11
S344
j = 1
13
S345
i = 1
12

FIG.40

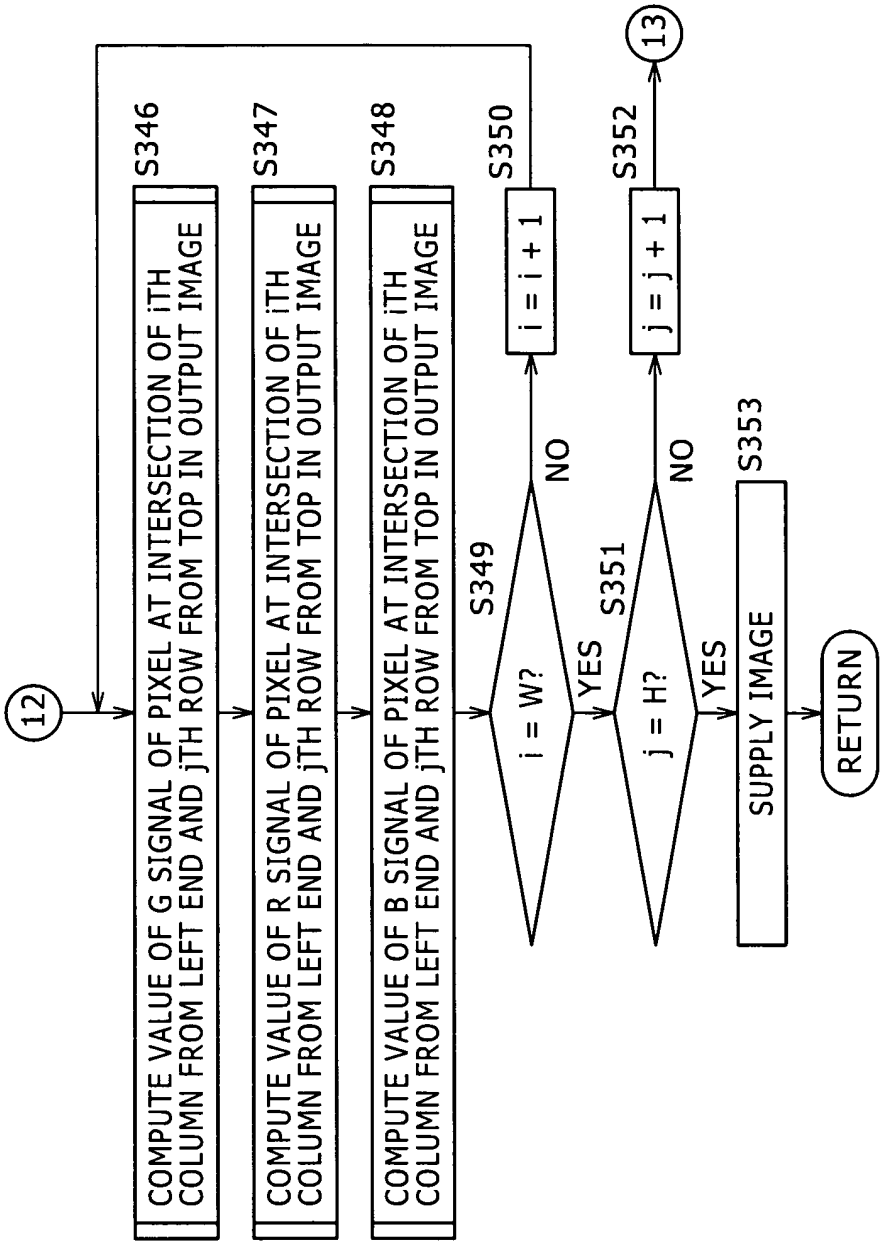

12
S346
COMPUTE VALUE OF G SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP IN OUTPUT IMAGE
S347
COMPUTE VALUE OF R SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP IN OUTPUT IMAGE
S348
COMPUTE VALUE OF B SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP IN OUTPUT IMAGE
S349
i = W?
NO
YES
S350
i = i + 1
S351
j = H?
NO
YES
S352
j = j + 1
13
S353
SUPPLY IMAGE
RETURN

FIG. 41

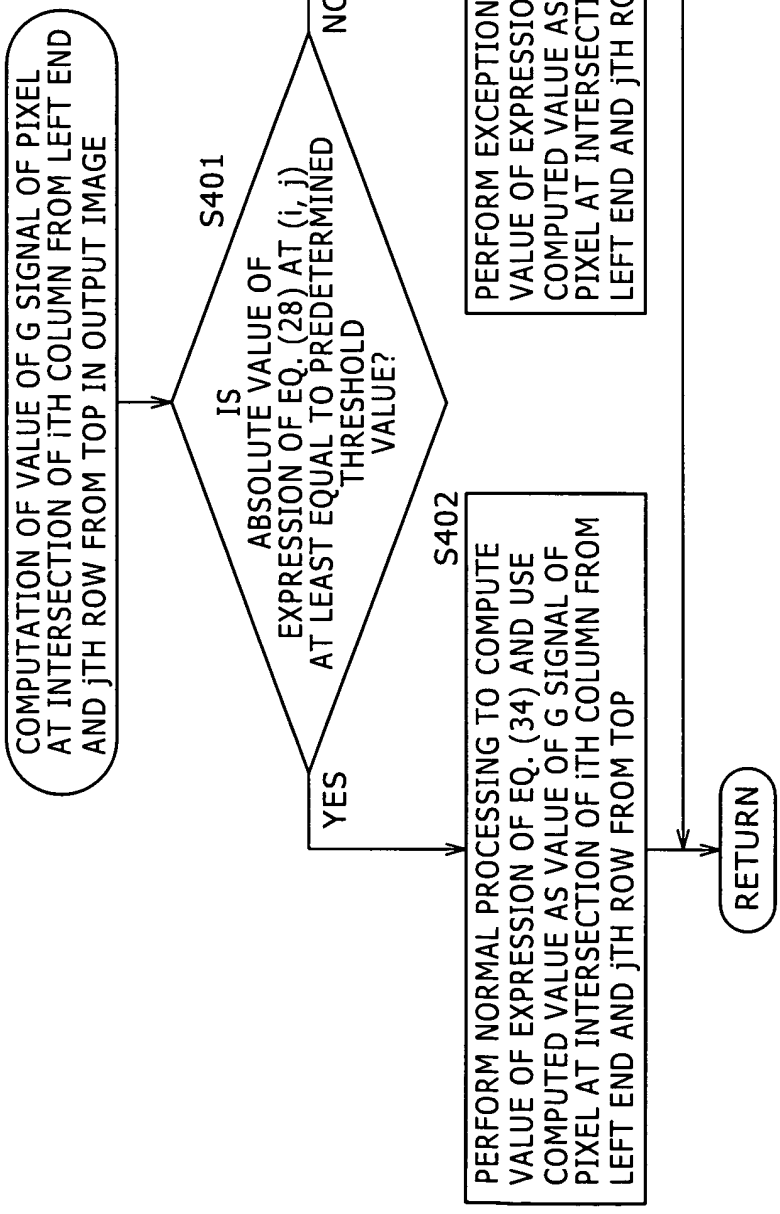

COMPUTATION OF VALUE OF G SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP IN OUTPUT IMAGE
S401
IS ABSOLUTE VALUE OF EXPRESSION OF EQ. (28) AT (i, j) AT LEAST EQUAL TO PREDETERMINED THRESHOLD VALUE?
YES
NO
S402
PERFORM NORMAL PROCESSING TO COMPUTE VALUE OF EXPRESSION OF EQ. (34) AND USE COMPUTED VALUE AS VALUE OF G SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP
S403
PERFORM EXCEPTION PROCESSING TO COMPUTE VALUE OF EXPRESSION OF EQ. (35) AND USE COMPUTED VALUE AS VALUE OF G SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP
RETURN

FIG. 42

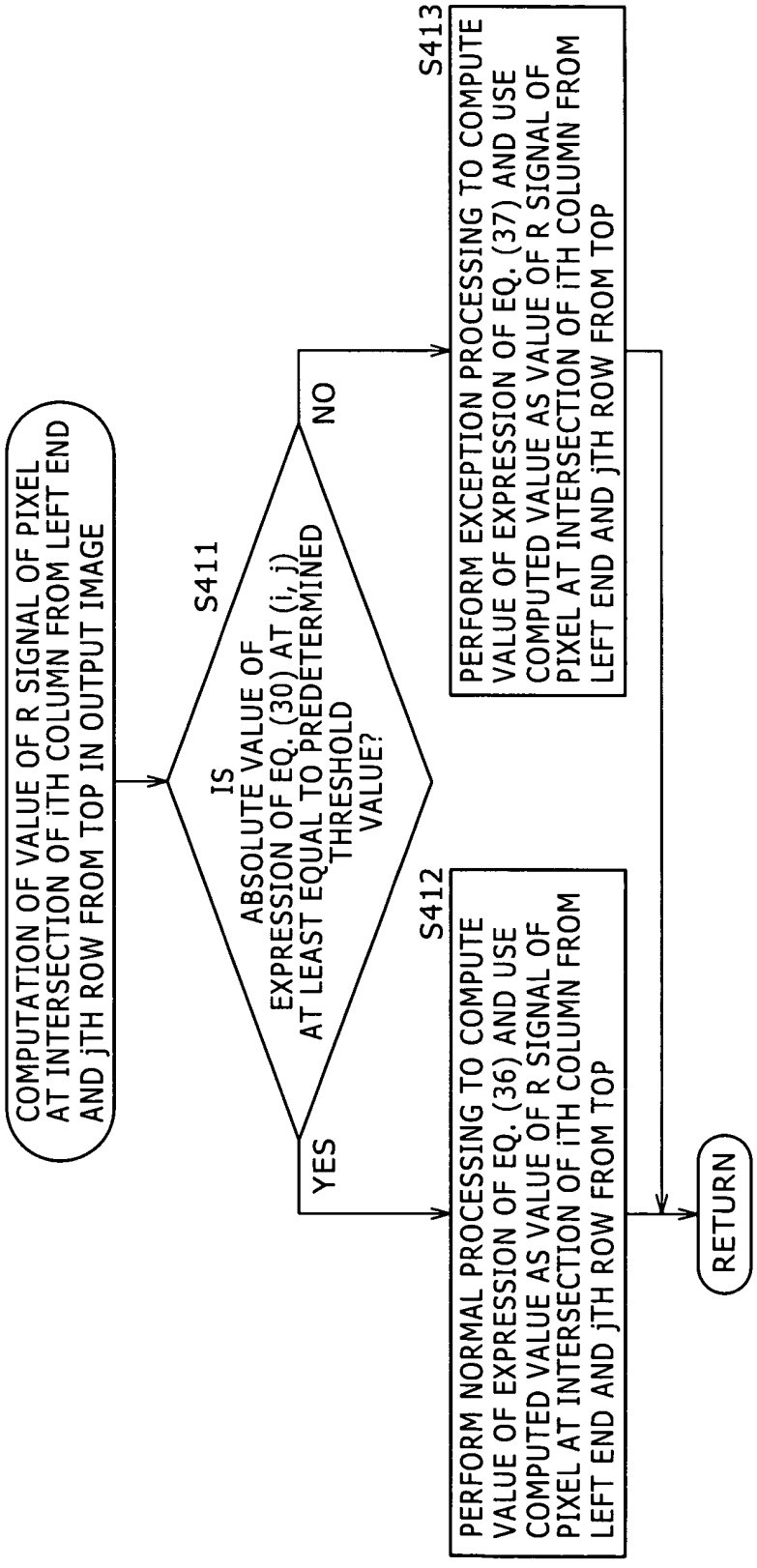

COMPUTATION OF VALUE OF R SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP IN OUTPUT IMAGE
S411
IS ABSOLUTE VALUE OF EXPRESSION OF EQ. (30) AT (i, j) AT LEAST EQUAL TO PREDETERMINED THRESHOLD VALUE?
YES
NO
S412
PERFORM NORMAL PROCESSING TO COMPUTE VALUE OF EXPRESSION OF EQ. (36) AND USE COMPUTED VALUE AS VALUE OF R SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP
S413
PERFORM EXCEPTION PROCESSING TO COMPUTE VALUE OF EXPRESSION OF EQ. (37) AND USE COMPUTED VALUE AS VALUE OF R SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP
RETURN

FIG. 43

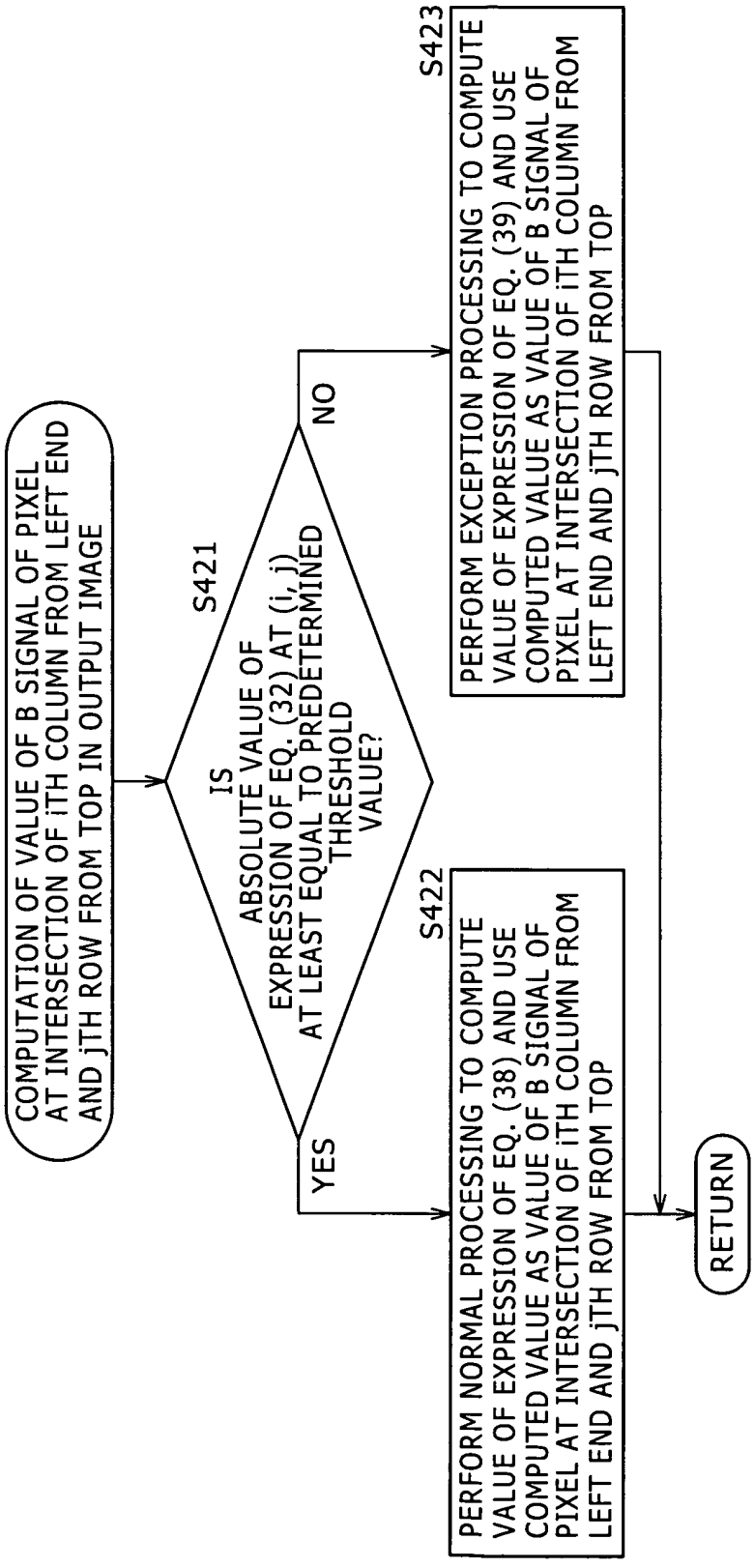

COMPUTATION OF VALUE OF B SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP IN OUTPUT IMAGE
S421
IS ABSOLUTE VALUE OF EXPRESSION OF EQ. (32) AT (i, j) AT LEAST EQUAL TO PREDETERMINED THRESHOLD VALUE?
YES
NO
S422
PERFORM NORMAL PROCESSING TO COMPUTE VALUE OF EXPRESSION OF EQ. (38) AND USE COMPUTED VALUE AS VALUE OF B SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP
S423
PERFORM EXCEPTION PROCESSING TO COMPUTE VALUE OF EXPRESSION OF EQ. (39) AND USE COMPUTED VALUE AS VALUE OF B SIGNAL OF PIXEL AT INTERSECTION OF iTH COLUMN FROM LEFT END AND jTH ROW FROM TOP
RETURN

FIG. 44

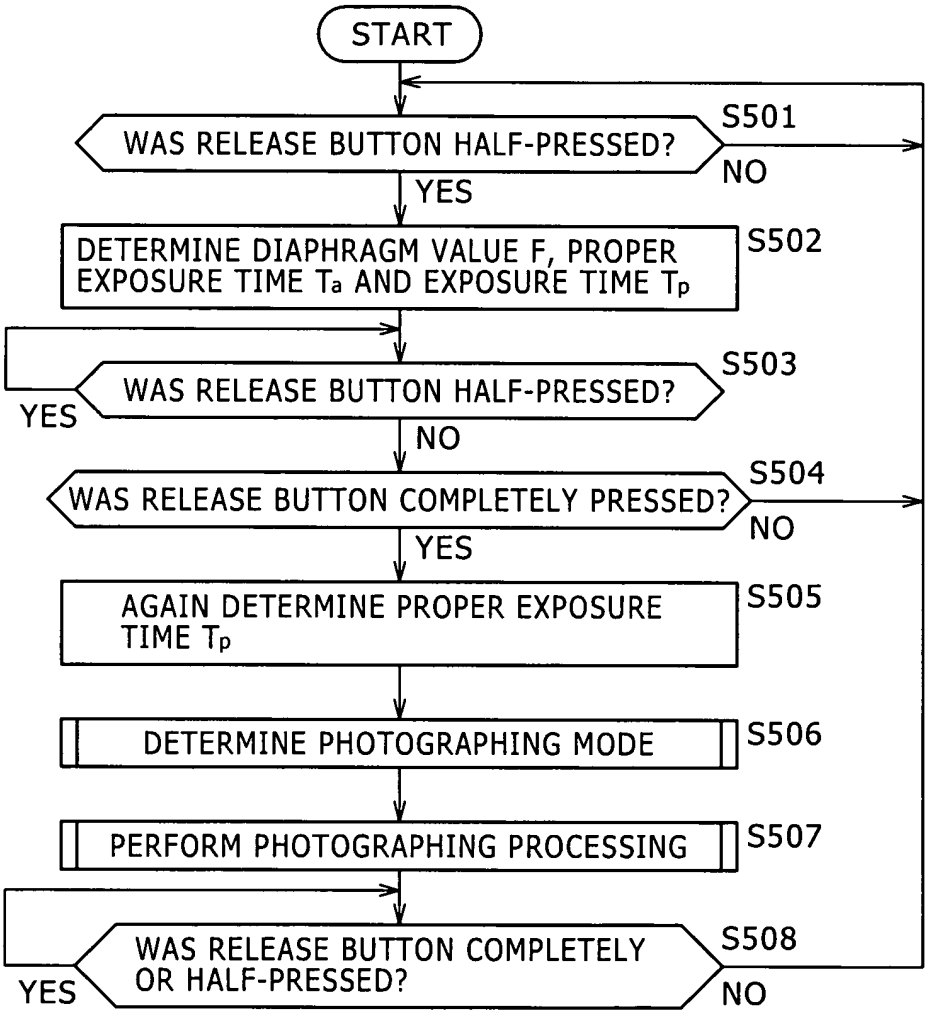

START
WAS RELEASE BUTTON HALF-PRESSED?
S501
NO
YES
DETERMINE DIAPHRAGM VALUE F, PROPER EXPOSURE TIME Ta AND EXPOSURE TIME Tp
S502
WAS RELEASE BUTTON HALF-PRESSED?
S503
YES
NO
WAS RELEASE BUTTON COMPLETELY PRESSED?
S504
NO
YES
AGAIN DETERMINE PROPER EXPOSURE TIME Tp
S505
DETERMINE PHOTOGRAPHING MODE
S506
PERFORM PHOTOGRAPHING PROCESSING
S507
WAS RELEASE BUTTON COMPLETELY OR HALF-PRESSED?
S508
YES
NO

FIG. 45

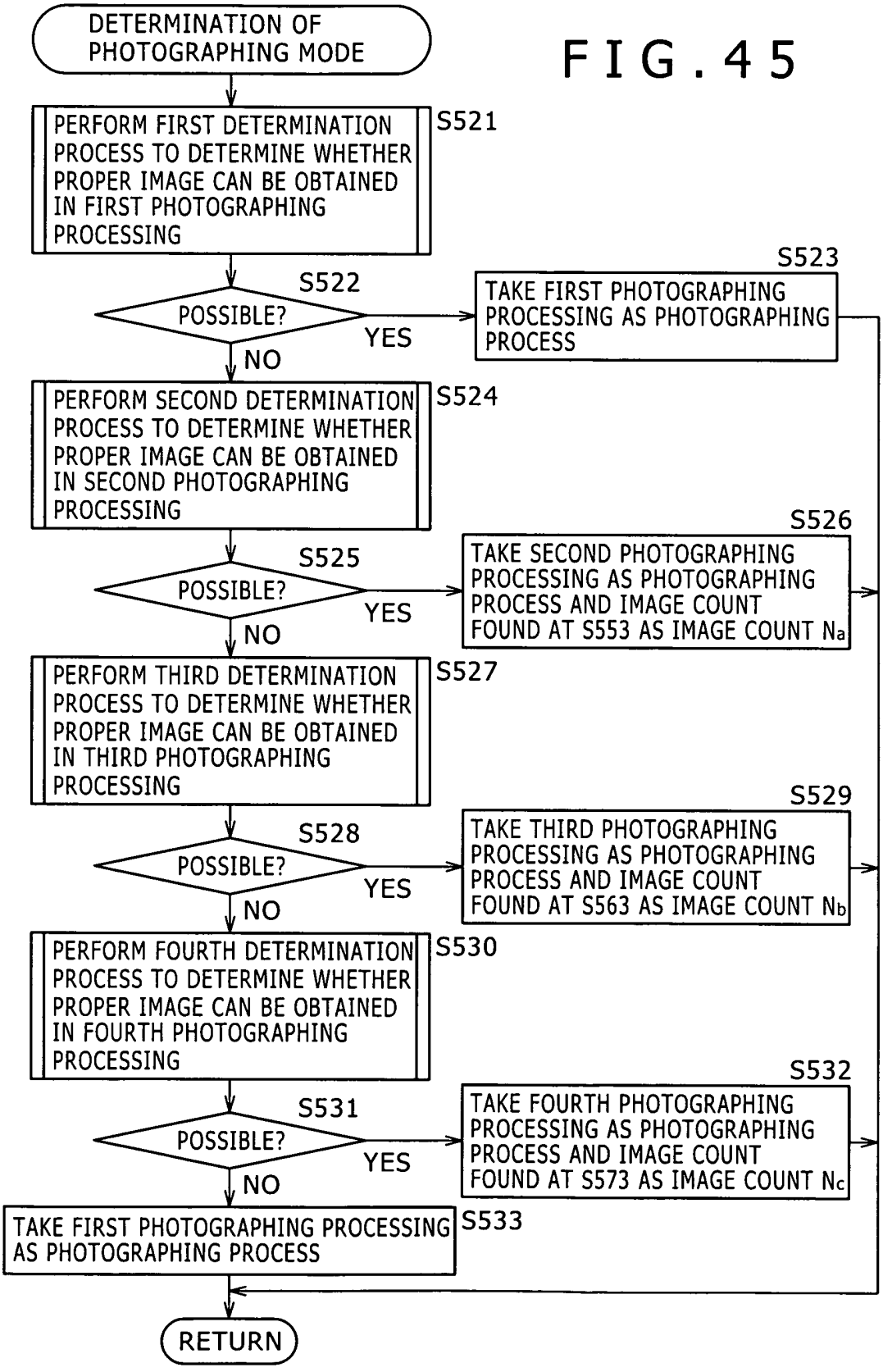

DETERMINATION OF PHOTOGRAPHING MODE
PERFORM FIRST DETERMINATION PROCESS TO DETERMINE WHETHER PROPER IMAGE CAN BE OBTAINED IN FIRST PHOTOGRAPHING PROCESSING
S521
S522
POSSIBLE?
YES
NO
S523
TAKE FIRST PHOTOGRAPHING PROCESSING AS PHOTOGRAPHING PROCESS
PERFORM SECOND DETERMINATION PROCESS TO DETERMINE WHETHER PROPER IMAGE CAN BE OBTAINED IN SECOND PHOTOGRAPHING PROCESSING
S524
S525
POSSIBLE?
YES
NO
S526
TAKE SECOND PHOTOGRAPHING PROCESSING AS PHOTOGRAPHING PROCESS AND IMAGE COUNT FOUND AT S553 AS IMAGE COUNT Na
PERFORM THIRD DETERMINATION PROCESS TO DETERMINE WHETHER PROPER IMAGE CAN BE OBTAINED IN THIRD PHOTOGRAPHING PROCESSING
S527
S528
POSSIBLE?
YES
NO
S529
TAKE THIRD PHOTOGRAPHING PROCESSING AS PHOTOGRAPHING PROCESS AND IMAGE COUNT FOUND AT S563 AS IMAGE COUNT Nb
PERFORM FOURTH DETERMINATION PROCESS TO DETERMINE WHETHER PROPER IMAGE CAN BE OBTAINED IN FOURTH PHOTOGRAPHING PROCESSING
S530
S531
POSSIBLE?
YES
NO
S532
TAKE FOURTH PHOTOGRAPHING PROCESSING AS PHOTOGRAPHING PROCESS AND IMAGE COUNT FOUND AT S573 AS IMAGE COUNT Nc
TAKE FIRST PHOTOGRAPHING PROCESSING AS PHOTOGRAPHING PROCESS
S533
RETURN

FIG. 46

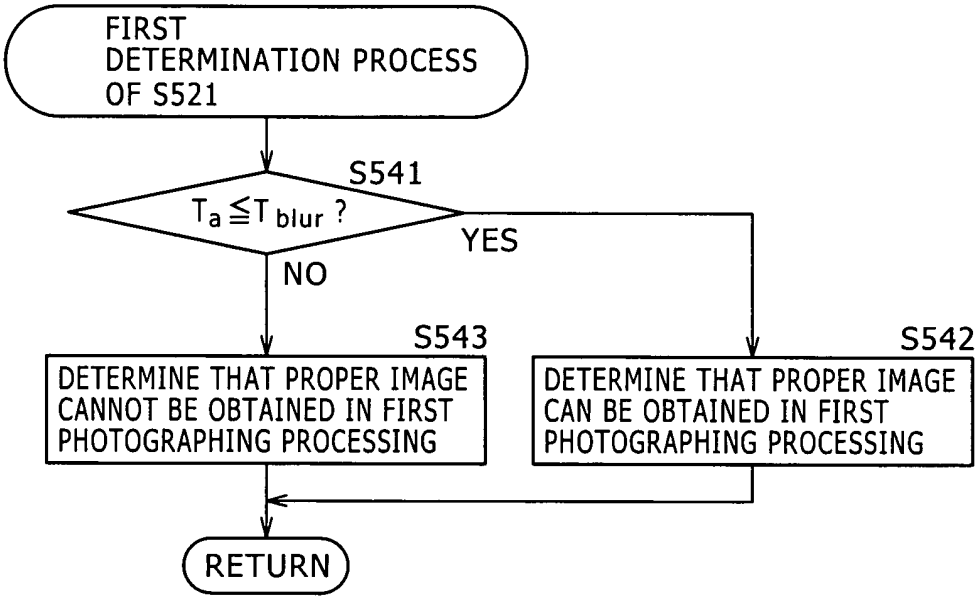

FIRST
DETERMINATION PROCESS
OF S521
S541
$T_a \leqq T_{blur}$?
YES
NO
S543
DETERMINE THAT PROPER IMAGE
CANNOT BE OBTAINED IN FIRST
PHOTOGRAPHING PROCESSING
S542
DETERMINE THAT PROPER IMAGE
CAN BE OBTAINED IN FIRST
PHOTOGRAPHING PROCESSING
RETURN

FIG. 47

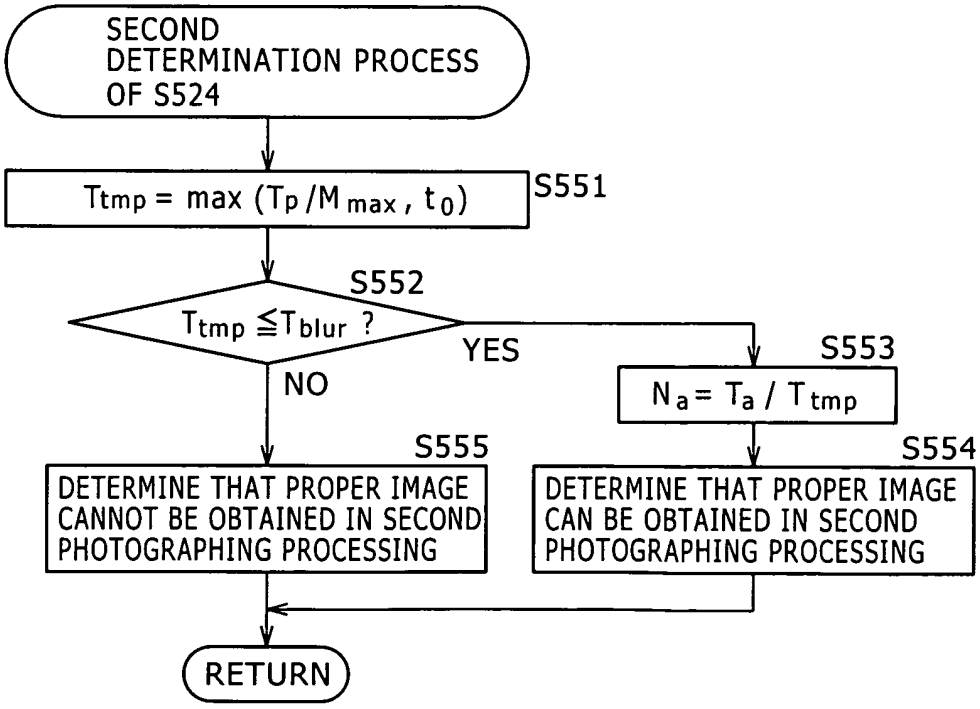

SECOND
DETERMINATION PROCESS
OF S524
$T_{tmp} = \max (T_p / M_{max}, t_0)$
S551
S552
$T_{tmp} \leqq T_{blur}$?
YES
NO
S553
$N_a = T_a / T_{tmp}$
S555
DETERMINE THAT PROPER IMAGE
CANNOT BE OBTAINED IN SECOND
PHOTOGRAPHING PROCESSING
S554
DETERMINE THAT PROPER IMAGE
CAN BE OBTAINED IN SECOND
PHOTOGRAPHING PROCESSING
RETURN

FIG. 48

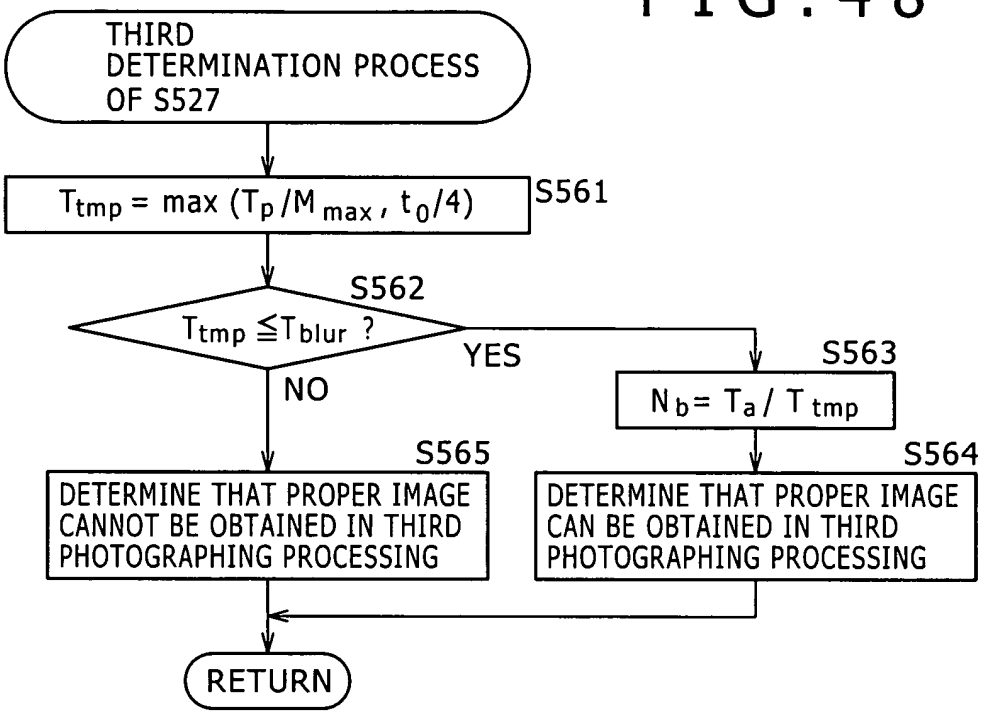

THIRD DETERMINATION PROCESS OF S527
$T_{tmp} = \max(T_p / M_{max}, t_0/4)$
S561
S562
$T_{tmp} \leqq T_{blur}$?
YES
NO
S563
$N_b = T_a / T_{tmp}$
S564
DETERMINE THAT PROPER IMAGE CAN BE OBTAINED IN THIRD PHOTOGRAPHING PROCESSING
S565
DETERMINE THAT PROPER IMAGE CANNOT BE OBTAINED IN THIRD PHOTOGRAPHING PROCESSING
RETURN

FIG. 49

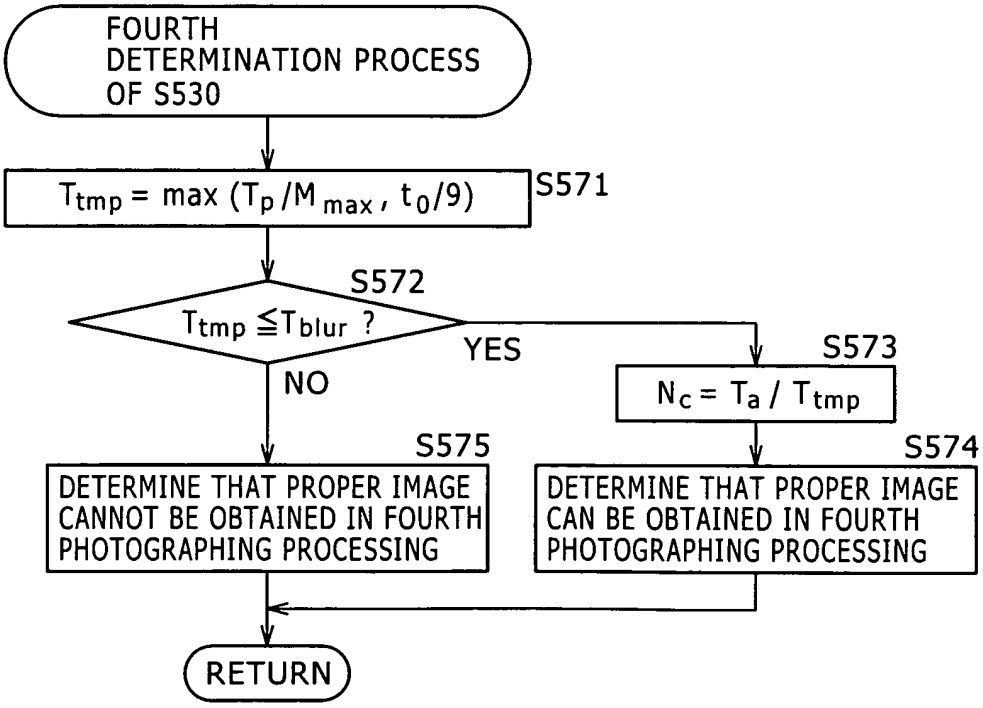
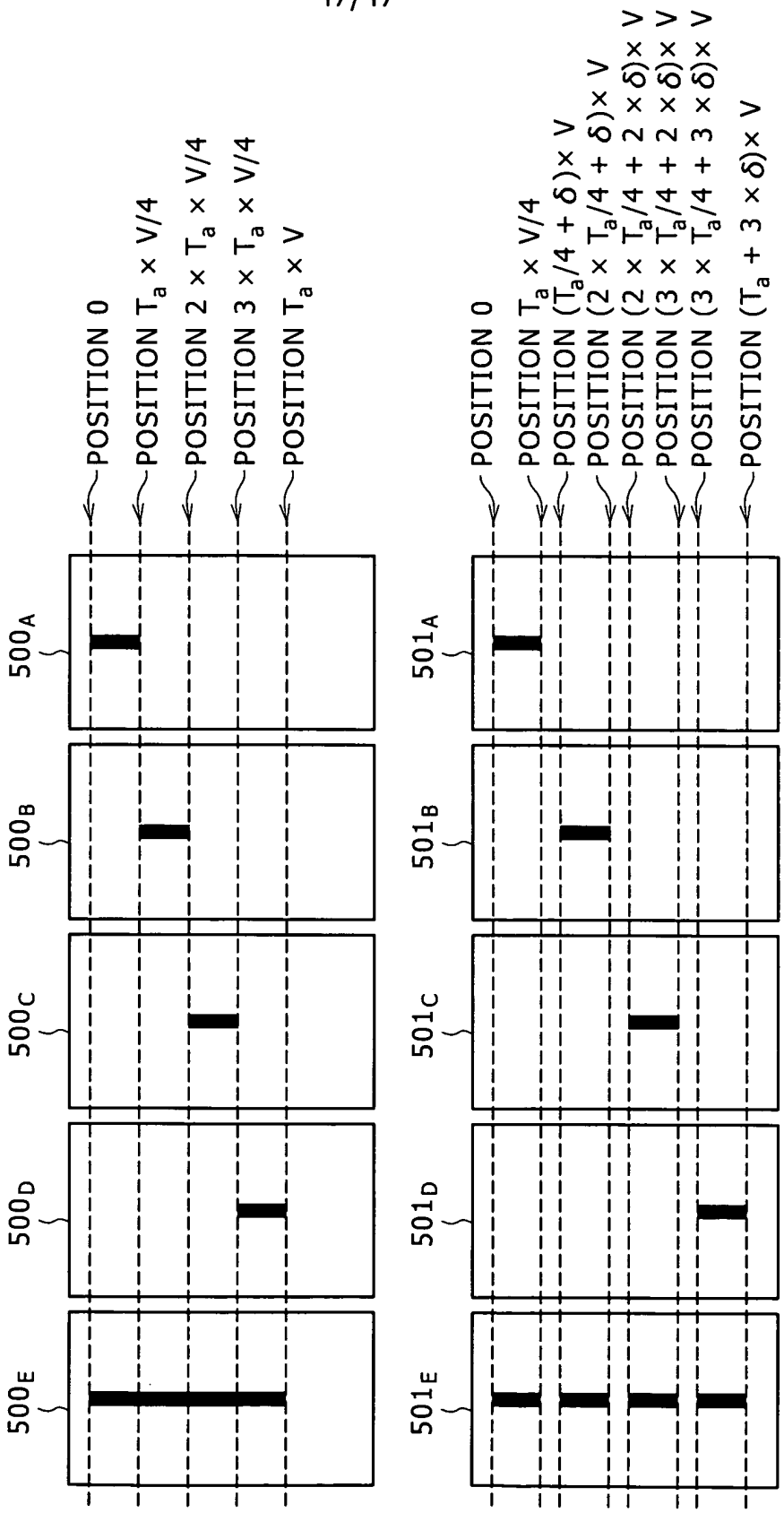

FOURTH DETERMINATION PROCESS OF S530
$T_{tmp} = \max(T_p / M_{max}, t_0/9)$
S571
S572
$T_{tmp} \leqq T_{blur}$?
YES
NO
S573
$N_c = T_a / T_{tmp}$
S574
DETERMINE THAT PROPER IMAGE CAN BE OBTAINED IN FOURTH PHOTOGRAPHING PROCESSING
S575
DETERMINE THAT PROPER IMAGE CANNOT BE OBTAINED IN FOURTH PHOTOGRAPHING PROCESSING
RETURN

FIG. 50


POSITION 0
POSITION T_a × V/4
POSITION 2 × T_a × V/4
POSITION 3 × T_a × V/4
POSITION T_a × V
500_A
500_B
500_C
500_D
500_E
POSITION 0
POSITION T_a × V/4
POSITION (T_a/4 + δ)× V
POSITION (2 × T_a/4 + δ)× V
POSITION (2 × T_a/4 + 2 × δ)× V
POSITION (3 × T_a/4 + 2 × δ)× V
POSITION (3 × T_a/4 + 3 × δ)× V
POSITION (T_a + 3 × δ)× V
501_A
501_B
501_C
501_D
501_E